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ORTHOPEDIC SURGERY

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BY

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PREFACE.

THIS book is written as a text-book for students and as a ready-reference book for general practitioners. A studied effort has been made to reduce its size by eliminating all that is not of practical value. Special stress is laid upon early diagnosis, and, instead of giving in detail every method of treatment that has ever been employed, only such methods are given as in the writer's experience have yielded the best results. The simplest kinds of apparatus, such as can most readily be applied by the general practitioner, are recommended. The book is written by a general surgeon who has taught orthopedic surgery for the past decade, and who believes that the orthopedic surgeon should know when and how to operate. The writer has endeavored to point out that desirable middle ground between the surgeon who operates too frequently and the orthopedist who seldom operates, believing that in this branch of surgery, as in everything else, the best is not to be found in the extremes. The writer bases his opinions upon his personal experience, but has referred freely to the writings of modern authors, especially to those of his associates in the American Orthopedic Association.

The author wishes to acknowledge his obligation to his colleagues, A. J. Gillette, George A. Hendricks, and W. A. Jones, for their kind assistance in procuring illustrations.

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ORTHOPEDIC SURGERY.

CHAPTER I.

INTRODUCTORY.

ORTHOPEDIC surgery comprises the prevention and correction of deformity. Its scope is not very clearly defined, nor is it desirable that it should be, because it is so essentially a part of general surgery that efforts to establish a dividing line between them are likely to jeopardize the best interests of both patient and surgeon. Since orthopedic surgery treats of the prevention and cure of deformity, it is rational to conclude that the orthopedic surgeon should treat every deformity and every disease that causes deformity. Many arbitrary lines have been drawn limiting the scope of this subject, but from year to year, as we learn to properly combine mechanical and operative treatment, it is bound to gradually expand, for it is certainly a long way from its proper limit yet.

It would be very desirable, from a scientific standpoint, to make a classification based upon pathology, but, for many obvious reasons, this is not practical. The subjects to be considered are comparatively few, and can be satisfactorily handled without formal classification.

It is only within the past few years that this has kept pace with other branches of surgery. Formerly it was looked upon as an uninviting and comparatively unimportant part of surgery; uninviting because, as formerly practised, the results were anything but satisfactory. The surgeon had not learned to drain joints, to do excisions and arthrectomies. He based his opinions upon false pathology, and was prone to turn the patient over to the physician, who in his turn lost sight of the diseased bone or joint, and many times of his patient, in trying to overcome what he was pleased to call scrofula and a strumous diathesis. An early diagnosis was not made, and bone- and joint-diseases were set down, owing to their late discovery, as local manifestations of a constitutional disease, for which very little could be done. If the medical man thought the patient might possibly be benefited by the application of an apparatus, he considered it beneath his dignity to apply it, and turned the helpless patient over to the tender mercies of an ignorant mechanic. The result was that much of the mechanical treatment of disease and deformity was placed in the hands of mechanics and irregular practitioners.

The present rapid advancement in orthopedy in this country is due largely to the earnest work of a very few American surgeons. When the writer graduated in 1873, his *alma mater*, Bellevue, was the only institution in the world that had a special chair of orthopedic surgery. At the present time many of our best colleges have established this chair, and we predict that the day is not far distant when no medical faculty will be considered complete without one, and when this branch of surgery will be as deserving and as well recognized as ophthalmology is at the present time. In answer to a letter of inquiry, Dr. Lewis A. Sayre, under date of May 10, 1889, wrote as follows: "You are perfectly correct in your statement of the condition of the college in 1873. . . . Bellevue Hospital Medical College can claim to be the pioneer in this department, as she was the first to establish a special chair for orthopedic surgery, and I had the distinguished honor of being called to fill it."

We have now, in the United States, active orthopedic societies, orthopedic sections of State societies, and the American Orthopedic Association, which is a part of the Congress of American Physicians and Surgeons.

In this esthetic age all are willing to acknowledge the importance of this branch of surgery. The good accomplished by the orthopedist is not confined to the relief of deformity, for he can relieve pain, prevent deformity, and save life and limb.

Americans are justly famous for their inventive genius and mechanical ingenuity, and it has been by these means that they have taken the lead in orthopedic surgery and brought it up to its present high standard. American orthopedic surgeons have invented many mechanical appliances for the treatment of orthopedic cases, and the secret of their success is that they apply the apparatus themselves, and do not send the patient to a manufacturer of or dealer in instruments, who knows nothing of disease. It would be just as proper for the physician, after having made the diagnosis, to send his patient to the druggist for treatment, as for the orthopedist to send his patient to the instrument-maker. It is a too common practice of the general practitioner of the present day to send orthopedic cases to the instrument-shops for treatment. This is altogether wrong, for the average dealer knows absolutely nothing about applying an apparatus. My instrument-maker frequently complains to me that physicians ask him to go and visit patients. He very properly says that that is not his business; that he is a manufacturer of mechanical appliances, and that he expects the doctor to give him measurements and explicit directions for each and every case, just as he would write a prescription for the druggist. The doctors have not been to blame for falling into this error in the past, for they have not had opportunities to learn to treat these cases properly themselves, and they have had no specialists to send them to.

At the present time, however, every man who assumes the responsibility of treating an orthopedic case is in duty bound to acquire the requisite knowledge and skill, for facilities are ample. Those who have neither time nor inclination to treat these cases are no longer excusable for sending them to the instrument-dealer, for worthy professional brethren are to be found who have given themselves special training in this branch, and who are willing and anxious to assume the responsibility.

The average instrument-dealer is just as ready to assume knowledge he does not possess, and to prescribe, as the average druggist is. There are, however, many worthy exceptions, and they are the ones who get the patronage of orthopedic surgeons.

The fact that mechanical appliances are so often necessary in orthopedics is one thing that has retarded the progress of this branch of surgery. It requires much time and patience to become skilful in their use, and the busy general practitioner finds it much easier to shift the responsibility upon some one else; and it is perfectly proper that he should, if the one to whom he sends the patient is better fitted than himself. But he is violating the trust imposed in him when he sends the patient to some one who knows nothing of surgery. Orthopedic appliances are quite expensive and often hard to get, but they are absolutely indispensable in many cases. An orthopedist's success often depends upon his ability to improvise an appliance that will meet the indications in a given case.

After it was found what could be accomplished by the scientific use of apparatus in orthopedics, the profession over the whole world became interested in the pathology of this much-neglected branch, and the consequences are that more advancement has been made within the past few years than in all time before, and that such unscientific terms as scrofula, white swelling, and hip-disease are rapidly becoming obsolete.

With our increase of pathologic knowledge came closer and more exact clinical observation and earlier and more accurate diagnosis. It naturally follows that our prognosis is better.

Diseases of bones and joints make up the greater part of an orthopedic surgeon's work. Our knowledge of the pathology of these affections has increased very rapidly of late. We are able to demonstrate, in a majority of cases of what was formerly known as strumous or scrofulous disease of bones and joints, that the trouble is a tubercular inflammation.

It is only within the past decade that even an orthopedist has been able to give a satisfactory answer to the question, What is white swelling of the knee? The great drawback has been, and is yet, that either no diagnosis or a wrong one is made. At the present time, in the majority of these cases, deformity has already taken place before they come under the orthopedist's care, thus depriving him of his greatest pleasure—viz., the prevention of deformity.

The younger members of the profession have the advantage over the older ones in having special teachers in this branch, and in learning from the lectures of experienced specialists practical points in early diagnosis and pathology that cannot be found in works on surgery.

Orthopedists have been in the past very prone to run in ruts, and have made very slow progress. They have frequently degenerated into mere mechanics, and have deprived themselves of the right to be called surgeons. While the writer believes that the orthopedist should be eminently conservative, he does not believe that conservatism consists in refusing to operate. The greatest obstacle to the rapid advancement of orthopedic surgery to-day is the tendency of the general surgeon to operate upon every orthopedic case that comes in his way, while the orthopedist too often refuses to operate, applying an apparatus to every case. Between the man who operates upon everything and the man who operates upon nothing the poor cripple is often badly treated, and orthopedic surgery is brought into bad repute. *To my mind, the ideal orthopedic surgeon is he who exercises the greatest judgment in drawing the line between the cases that require operation and those that do not; who is equally skilful, on the one hand, in applying the knife, and, on the other, in applying the proper apparatus, and who is without prejudice in either direction.*

The term "orthopedia" is derived from two Greek words, meaning "straight" and "child." Its original scope was very narrow, being restricted, as the name implies, to the straightening of crooked children. At that time orthopedia and surgery had very little in common, since the orthopedist did very little operating.

Orthopedia as a distinct branch of surgery may be said to have had its origin with subcutaneous tenotomy, first practised by Stromeyer, of Hanover, in 1831. The name was coined by Andry in 1741, but very little had been accomplished before Stromeyer's time. Stromeyer's idea was that, by excluding the air from the wound, suppuration and its attendant dangers could be avoided. He also taught that no attempt should be made to overcome the deformity until after the healing of the tenotomy wound, fearing that any such attempt would cause suppuration. This, like every other important operation, was at one time greatly abused, and bid fair to do more harm than good; but, fortunately, reaction set in before it was too late. Tenotomy naturally led to osteotomy, myotomy, and other subcutaneous surgery, which were forerunners of antiseptic surgery.

The most ancient writers upon orthopedia were Hippocrates, Galen, and Celsus. Every nation has contributed its share toward the development of this branch of surgery. Among the French the names of Bouvier, Bonnet, Delpech, Guerin, and Malgaigne are prominent.

In Germany, Dieffenbach, Heine, and Langenbeck take the lead.

In 1839, Valentine Mott, New York's greatest surgeon, thought so well of the French school of orthopedy that he went to Paris, where he spent three years with Guerin to learn his methods.

In England, Adams, Brodhurst, Little, and Thomas were active workers in this department. Little, who but recently died, was himself afflicted with club-foot, and on this account became especially interested. His influence resulted in establishing the Royal Orthopedic Hospital. He was the first to perform subcutaneous tenotomy in England, in 1837.

Tenotomy was first performed in America in 1834, by David L. Rogers, of New York. The first important writing upon this subject in America was done by Henry J. Bigelow, of Boston, who won the Boylston prize in 1844 with an essay in answer to the query: "In what cases and to what extent is the division of muscles and tendons or other parts proper for the relief of deformity or lameness?"

In addition to those already mentioned, the names of Buckminster Brown, Buck, Detmold, Davis, Sayre, and Taylor stand out in bold relief. At the time when these men began their active work in this direction, American surgeons were opposed to specialties in general, and were disposed to look upon orthopedia as belonging to mechanics rather than surgeons. Thanks to the above-mentioned men and to a younger generation of earnest and enthusiastic workers, this branch of surgery will now compare favorably with any other. Had it not been for the efforts of these men in rescuing orthopedy from the mechanics, it might not have been in position to keep up as it has with the advances in all branches of surgery, following the principles first laid down by the renowned Lister.

With all our advancement we must admit that orthopedic surgery is far from perfect. The well-known tendency of our beloved profession to go to extremes is more marked in this than in any other department. The importance of early diagnosis cannot be too strongly impressed upon the medical profession, for those who are interested in this work know that this is a weak point with the rank and file of the profession. When an early diagnosis is made in a joint-inflammation, we can be truly conservative and prevent suffering and deformity in many cases.

Diagnosis.—The diagnosis of deformities requires, as a rule, inspection only, but beginning joint-diseases require careful study. Every child who limps or complains of persistent pain should be carefully examined for a beginning joint- or spine-inflammation. The one symptom common to all these troubles upon which the greatest reliance can be placed is limitation of motion, such as can be elicited by gentle manipulation. It will not do to administer an anesthetic to make this examination, because this would allay the muscular spasm, and the slight resistance to motion would disappear. It is very important to be familiar with the normal appearance of every part of the body. The surgeon should study the outlines of the body as carefully as an artist does, and be able to detect the slightest deviation from the normal. In examining a suspected joint, its fellow should always be exposed for comparison. In children the clothing should all be removed for an examination, and it is often necessary to follow the same rule with adults.

The attitude when sitting and standing should be observed. It is very important to study the gait of the patient. Veterinarians become very expert in locating the seat of lameness or disease by studying a horse's gait, and we should employ the same method in children who are too young to tell us just where the trouble is. It is quite important to study the gait of an adult, because objective symptoms are always much more valuable than subjective ones. Subjective symptoms are often very misleading, for the patient almost always has a theory of his own as to the cause of his trouble, and is very liable to unwittingly warp the facts to fit his theory.

Much valuable information can be gained by intelligent use of the tape-measure. One of the earliest symptoms of an ostitis is muscular atrophy, and it may be detected by measurement before it is perceptible to the unaided eye. It should be borne in mind that the right side of the body in right-handed persons is usually a little larger than the left. There is also, not infrequently, a difference between the length of the limbs when no disease is present. This difference is sometimes so marked as to cause a decided tilting of the pelvis and curvature of the spine.

Prognosis.—The prognosis in orthopedic surgery is generally believed to be bad; but this a mistaken idea, based upon experience with older methods and neglected cases. Without treatment, deformities and deformity-producing diseases have a decided tendency to grow progressively worse, but with modern treatment the results will be satisfactory to both patient and surgeon. The writer knows of no deformity in which it is safe to promise the parents that the child will "grow out of it." Orthopedists are no more capable of performing miracles than other men, and cannot be expected to perfectly restore the function of a joint which has been allowed to go on to destruction, instead of being properly treated, but when they are given these cases early their results are truly marvelous, considering the nature of the disease they have to contend with.

Prophylaxis.—Next in importance to diagnosis in this or any other department is prophylaxis. Children should be encouraged in athletic sports, such as swimming and ball-playing. The ancient Greeks, probably the most perfectly developed race physically, owed their supremacy to athletics and temperance. A very important part of a surgeon's duty when treating a joint-inflammation is to prevent, if possible, a deformity. The same is true of cases of poliomyelitis, or paralysis from any cause. In short, in every disease known to be followed by deformity, the surgeon is neglecting his duty when he fails to resort to proper prophylactic measures.

Therapeutics.—The therapeutics of orthopedic surgery comprise medicinal, mechanical, and operative measures.

There is no specific medication in this department, except when we meet with a deformity or joint-lesion due to syphilis. Pain is a very common symptom in these cases, but, owing to the fact that we are dealing with chronic cases, opiates are contra-indicated; they should be rarely, if ever, resorted to, for fear the patient may acquire the opium-habit. It is very wrong to give opiates for a long time to children and then deprive them of them, because the older patients tell us that under these circumstances the suffering caused by the want of the drug is greater than that caused by the disease. Tonics and aids to digestion are the medicines mostly called for. They are often very valuable aids to our other treatment, but since we have learned that joint-inflammations are local, and not constitutional, we do not expect to bring about a cure by medicines. Cod-liver oil has had, and still has, with many, a great reputation in chronic inflammations, but it is a food rather than a medicine, and, in the writer's experience, does not compare favorably with good, rich milk. It is very disagreeable to most patients, and is liable to disturb the stomach and destroy the appetite.

Mechanical Appliances.—Proper skill in the application of mechanical appliances for the relief of deformity can be acquired only by careful study and long experience. For this reason plaster-of-Paris often yields better results than the most cunningly-devised apparatus.

Braces should be light, strong, and well-fitting, for, at best, they are more or less a burden, and when ill-fitting may be as great a source of suffering as the disease for which they are applied. An appliance should never be a source of pain, but, on the contrary, should relieve pain as well as deformity.

Aluminum, on account of its lightness, may at some time be of great value to orthopedists, but at present its expense is too great to allow of its coming into general use. Annealed steel is the material most commonly used for making orthopedic appliances. It can be bent so as to fit properly, and is strong enough to give needed support without being very heavy. It must be carefully padded wherever it comes in contact with the skin. Soft leather, felt, or pads filled with ground cork are the materials most used for padding. Appliances of felt, leather, wood, and paper can often be used to advantage.

It is very important to bear in mind that the brace must be made to fit the patient, and not the patient to fit the brace. The orthopedist depends upon mechanical appliances to do his best work. By their proper use he can often relieve pain, prevent deformity, and cure disease. When applied early enough, they will in the majority of cases prevent the necessity for operative treatment. A brace should never be looked upon as a substitute for an operation, when an operation is clearly indicated. In orthopedic surgery an operation usually requires mechanical treatment to complete the cure. Many failures are due to the neglect of proper mechanical treatment after an operation. The mechanical and operative treatments of orthopedic cases should never be considered as rivals, but as aids to each other. It is only by the proper combination of the two that the best results can be obtained.

Operative Treatment.—There are but few operations coming under the head of orthopedic surgery. Some of them are often preliminary to proper mechanical treatment, while others—for example, opening of abscesses and excisions—are indicated later, when mechanical treatment has failed.

It is very unfortunate to speak of mechanical treatment as conservative, in the sense that it is opposed to operative treatment, or that operations are not conservative. Mechanical treatment has been greatly abused in the name of conservatism. True conservatism requires that an operation be performed when it will best meet the requirements and save the patient time and suffering.

Plaster-of-Paris.—There is no one agent of greater value to the orthopedic surgeon than plaster-of-Paris, for in his skilful hands it can be satisfactorily used in most cases coming under his care. One often hears it spoken of in a disparaging manner, but only by those unskilled in its use. On account of its cheapness and ready adaptability to such a great variety of cases, it is of untold value in charity work, and is not to be despised in the treatment of the deformed and suffering among the better classes.

None but the very best dental plaster should be used. There is a decided difference in different specimens of the dental plaster. When rubbed between the fingers it should have no grit, but should feel like flour. Good plaster, properly prepared, will set so quickly that the surgeon's hands need never be tired from holding the member in the proper position, and the cast need be no heavier than so much pasteboard.

The ordinary commercial plaster is utterly unfit for use, because it will not set within a reasonable time and is heavy and unmanageable.

It is rarely that satisfactory plaster bandages can be bought, because, as a rule, they are made of inferior material, are too tightly wound, and even when properly made do not keep well. Bandages should be freshly prepared and kept in a dry place, preferably in a tin box with a tight-fitting cover. Cheese-cloth should never be used in preparing plaster bandages, because it makes too heavy a bandage, and one that will not set quickly on account of the large amount of moisture held in the cloth. The coarser crinoline, used by dressmakers and kept in every dry-goods store, is the best material for this purpose. The sizing must be removed from the crinoline by washing it in cold water, for while it is much easier to handle with the sizing in, it will so interfere with the setting of the plaster that it is not fit for orthopedic work. A very nice, smooth bandage can be made without removing the sizing, and will do very well for fractures or anything that does not demand a quick-setting bandage. When the crinoline is thoroughly wet in cold water and wrung out, and then wet in a fresh supply of cold water and again wrung out, it will retain just enough of the sizing to make it easy to handle, and not enough to interfere with quick setting. Prolonged soaking in cold water, or washing in warm water, removes all the sizing, and makes the material so soft that it is difficult to get the plaster into it. For ordinary use the bandages should be six yards long and two and one-half inches wide; for plaster-jackets, four to six inches, and for club-feet, one and one-half inches wide. One can best get the plaster into the crinoline by spreading the latter on a table and throwing a quantity of plaster over it, after which the surplus plaster is rubbed off with the hand. The bandage is rolled up carefully, as the surplus is rubbed off, just tight enough to make a solid roll, but not so tight that the water cannot readily get into every part of it. Bandages may be kept some length of time when wrapped in paraffin paper and sealed up. Quite a quantity of water should be used to wet the bandage; if only a small basin of water is used, it will not be sufficient to cover the bandage, and it will soon become so impregnated with plaster from the outer layers of the bandage that it will fail to reach the deeper layers. The water should be neither hot nor cold, but just comfortably warm.

When a number of bandages are to be used, they should not all be put into the water at once, but should be stood on end in the water, one at a time, the second one being put in just as the first one is taken out. The first bandage should not be put into the water until everything is ready for its application. When good plaster-of-Paris is used, it is not necessary to use salt in the water. The lightest, best-fitting, and most comfortable cast is one applied directly to the skin, without any dry bandage underneath; but when the part is hairy it must be shaved, or a dry roller applied underneath the plaster.

The writer has tried almost every kind of plaster-cutter ever manufactured, and has found them all unsatisfactory. Figure 1 shows a good variety of plaster-knife, the handle being so shaped that it can be used as a lever to pry the cast open. An ordinary pocket-knife is a very good instrument for this purpose. A wet sponge or towel should be used to dampen the cast along the line where it is to be cut. If a scratch be made first with the knife, the water will penetrate more readily, and in this way the cast can be made so soft in a few seconds that it will cut like putty. Dilute acid, vinegar, and bichlorid solution have all been used to soften the cast, but they are no better than water. When the cast is properly softened, the knife can be entered at the upper end and passed to the lower end, cutting through the whole thickness at once. When a cast is difficult to remove, either poor plaster or too much plaster has been used. The most common mistake in using plaster is made in using too much. A cast extending from the ankle to the body on an adult patient does not necessarily weigh over a pound.

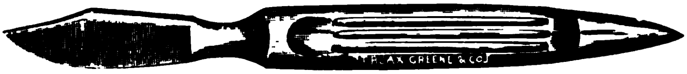

Fig. 1.—Esmarch's knife and wedge.

CHAPTER II.

DEFORMITIES OF THE SPINE AND THORAX.

In the infant the spinal column is practically straight, but as the child begins to assume the upright position four physiologic curves are formed—the cervical, dorsal, lumbar, and lateral. In the cervical and lumbar regions these normal curvatures have their convexities looking forward, and in the dorsal region the convexity looks backward. The lateral curve is usually not very pronounced, but occupies the whole length of the dorsal region with its convexity looking toward the right.

The pathologic curvatures of the spine that come to the orthopedist are mostly an exaggeration of these normal curves. The normal curves are a little more pronounced in the evening than in the morning, so that an adult is from 13 to 14 mm. shorter in the evening than in the morning. These normal curves are frequently considerably exaggerated, because the individual is obliged, by his occupation, to assume certain positions for many hours each day. The vast majority of these cases are not considered pathologic because they are well understood to be due to the occupation, and because they give rise to no discomfort. The most common variety of this deformity is stoop-shoulders. Since these normal curves are so uniform in their position and extent, it is evident that they are a part of nature's plan to give each part of the body the shape best adapted to its uses. While they are not so marked as to interfere with the weight-carrying function of the spine, they are sufficient to add very materially to its flexibility. The flexibility and elasticity of the spine can be wonderfully increased by constant practice continued over a long series of years, as evidenced by acrobats. There is no evidence to prove that acrobats are subject to spinal curvatures or diseases. On the contrary, the absence of spinal disease among them is proof of the value of physical culture. That they do not acquire pathologic or posture-curves is evidently due to the fact that they are constantly bending the spine in every direction.

Anteroposterior curves with the convexity posteriorly are called *kyphosis* (hump-back). Anteroposterior curves with the convexity anteriorly are called *lordosis* (to bend). Lateral curves are called *scoliosis* (curved).

Kyphosis.—Kyphosis may indicate either a harmless physiologic condition or a very grave pathologic condition. It is very important, therefore, to ascertain the cause in every case. It may be due to Pott's disease, rickets, osteomalacia, rheumatoid arthritis, paralysis, old age, occupation, muscular weakness, or habit.

Pott's disease is the gravest disease of which kyphosis is a symptom. The kyphosis of this disease is characterized by an unusually sharp angle and by being very rigid. These two points, together with the history and other symptoms of this disease, should be sufficient to establish the diagnosis. (For further information on this point see diagnosis in the chapter on Pott's Disease.)

Kyphosis due to rickets is most marked in the lower part of the spine, and is a long, even curve, rather than an angle, and will disappear when the patient lies prone. Enlarged epiphyses and curvatures of other bones will also be present.

In osteomalacia the kyphosis will be accompanied by brittle bones and other characteristic symptoms.

Rheumatoid arthritis occurs in elderly people, and affects the joints of the extremities as well.

In kyphosis due to paralysis the weakened, helpless condition of the muscles will be so evident that no mistake need be made in diagnosis.

The kyphosis of old age is familiar to all, and is due to muscular weakness and to change of shape in the intervertebral disks. When the muscles begin to give way, the pressure is so increased upon the anterior margin of the disks that it causes absorption.

Tailors, shoemakers, and persons who have to carry heavy burdens are liable to become stoop-shouldered.

Treatment.—For the round shoulders due to occupation, little or nothing can be accomplished without change of occupation.

Round shoulders in young persons, due to habit or to muscular weakness, may be greatly benefited, and often cured, by treatment.

Shoulder-braces or mechanical appliances are to be avoided in these cases, because they do more harm than good. Braces are very liable to be the source of great discomfort and will interfere with proper muscular development. The patient should have plenty of out-door exercise, and if generally weak should take tonics and aids to digestion.

The bowels, if constipated, should be regulated by an A. S. & B. pill, or a dose of cascara at night. Electricity and massage are very valuable aids in the treatment of these cases. The patient should be instructed to suspend himself by his hands repeatedly, several times every day. He should use dumb-bells or Indian clubs. He should lie upon his back with a solid support under his shoulders, and his arms stretched above his head, and use light dumb-bells while in this position. There is no better exercise for these patients than bicycling, if they will sit upright. The writer is satisfied that round shoulders are often caused by the vicious habit of sleeping with too many or too large pillows under the head. Children should be taught to sleep with but one small pillow. When they use more than this, they are liable to grow round-shouldered and flat-chested. This plan of treatment, faithfully carried out, usually renders the prognosis good in young patients in whom the deformity is not yet fixed.

Lordosis.—Lordosis is an exaggeration of the normal curves in the cervical and lumbar regions. In the cervical region it is rare and of comparatively little consequence. In the lumbar region it is quite common, and is usually compensatory to a kyphosis in the dorsal region, as in Pott's disease. This deformity may be caused by carrying a weight in front of the body. It is present to a greater or less degree during pregnancy and with large abdominal tumors. It may be present with paralysis, involving the muscles of the back. Tailors are sometimes afflicted with lordosis on account of the permanent contraction of the psoas muscles, from the position which they occupy while at work. Hip-joint disease and congenital dislocation of the hip are accompanied by lordosis.

Deformities of the Thorax.—Deformities of the thorax may be congenital or acquired. The congenital variety usually consists in a projecting forward of the sternum and costal cartilages, constituting the so-called "pigeon breast." It has no pathologic significance, and has a tendency to disappear as the person grows older. Pigeon breast accompanies Pott's disease in the upper dorsal region, and is in this case a permanent deformity which does not require treatment because it is compensatory. It also accompanies some cases of rickets. The thorax is sometimes very badly deformed in scoliosis, and will be mentioned under that head.

CHAPTER III.

SCOLIOSIS; LATERAL CURVATURE; ROTARY LATERAL CURVATURE.

Scoliosis is a deformity of the spine characterized by a lateral deviation (Figs. 3 and 4). It is usually an exaggeration of the normal curves of the spine, and is the most common spinal deformity.

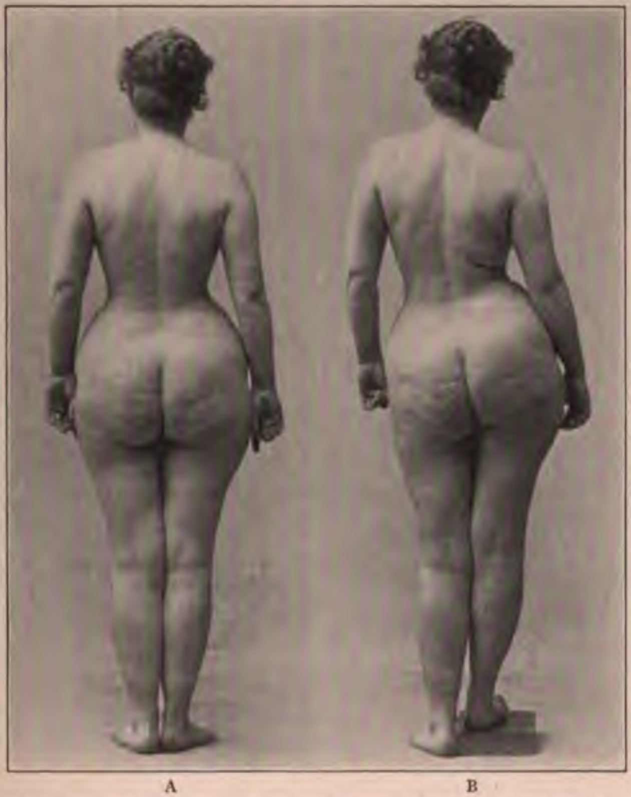

Fig. 2.—A, normal spine showing iliocostal spaces of same size and shape on both sides; B, curvature of spine produced by tilting the pelvis; iliocostal spaces changed.

In the majority of cases, the most marked curve is toward the right, and is located in the upper dorsal region. There is usually a compensatory curve in the opposite direction in the lumbar region.

Etiology.—Scoliosis is very rarely congenital, the majority of cases occurring between the ages of eight and fifteen years. It usually occurs in girls who are growing tall very rapidly. Of 229 cases reported by Ketch, 189 were in females and only 40 in boys.

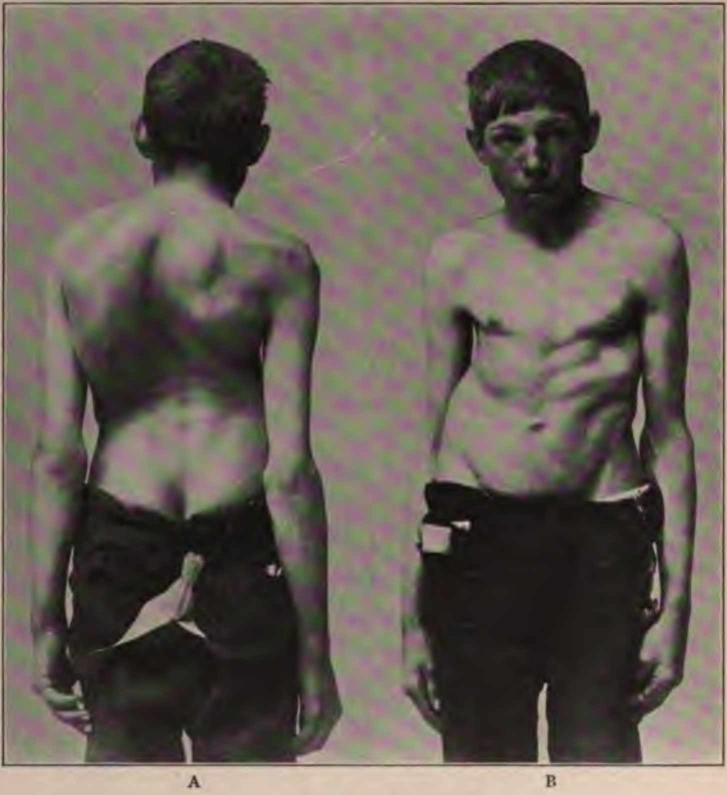

Fig. 3.—Left scoliosis: A, back view; B, front view.

What the exact cause is, in the majority of cases of scoliosis has not been clearly demonstrated. A few cases are evidently due to a short or deformed limb, as, for example, following hip-joint disease; others follow infantile or other paralyses affecting one lower extremity (Fig 5). Empyema is also an occasional cause (Fig. 6). There must, however, be some additional cause or weakness aside from the short or deformed limb or the empyema, because shortening and deformity of one limb or empyema are not often followed by scoliosis. Occupation seldom, if ever, causes this deformity, because it begins in children. The deformity is probably toward the right

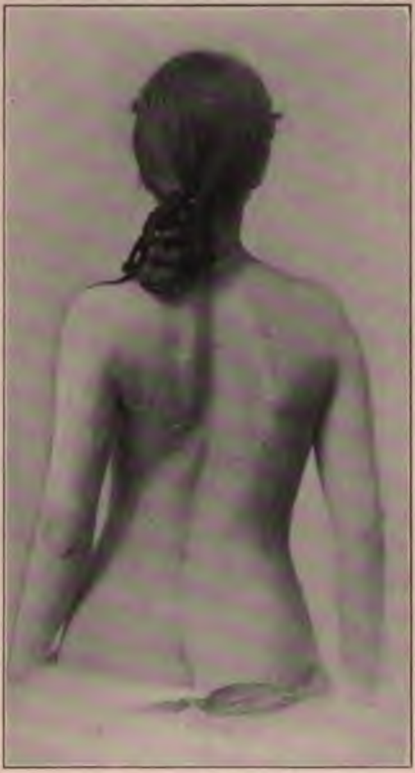

Fig. 4.—Right scoliosis.

in the majority of cases, because most people are right-handed.

Many theories have been advanced, but none proven. Some have believed that the deformity is caused by contraction of the muscles on the concave side, but there is no evidence of muscular spasm or contraction. Others have claimed that paralysis of the muscles on the convex side is the cause, but these muscles respond to electric stimulus. The most rational theory is that the deformity is simply an

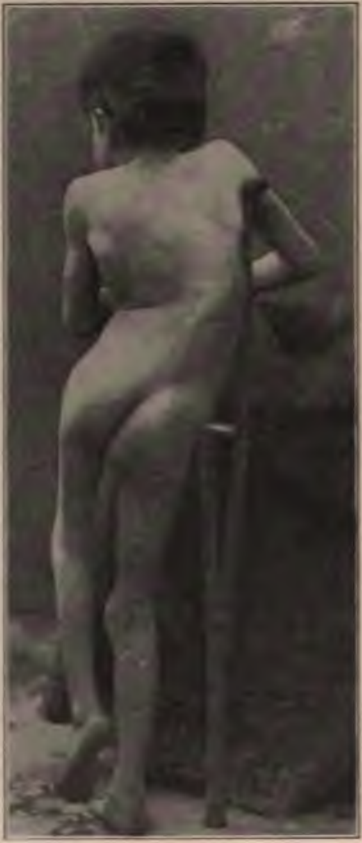

Fig. 5.—Curvature of spine due to infantile spinal paralysis (Gillette).

exaggeration of the normal curves of the spine, caused by the superincumbent weight. Heredity seems to have no bearing.

Pathologic Anatomy.—Scoliosis can only be spoken of as a deformity and not as a disease, because it has no pathology. There is no inflammation or change of any kind in the bony or soft parts. In extreme cases the bodies of the vertebræ are changed in shape somewhat by the pressure (Figs. 7 and 8). The edges of the bodies next to the concavity of the deformity are made thinner by

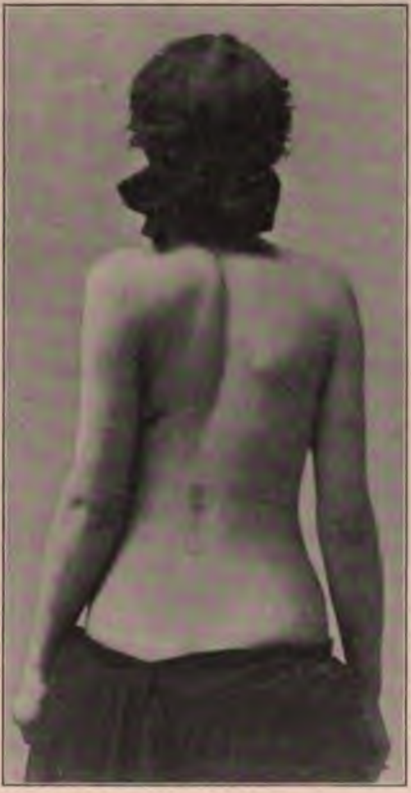

Fig. 6.—Scoliosis due to empyema.

absorption. The intercartilaginous disks become absorbed on one side by pressure. Occasionally, in severe cases, a mild pressure ostitis occurs, so that the bodies may be united by a deposit of new bone. The ribs are greatly distorted, being depressed on the concave side and forming a prominence on the convex side. The muscles on the convex side are somewhat atrophied and fattily degenerated, on account of the prolonged overstretching to which they have been subjected. On the concave side they are somewhat contracted, and not so much changed as on the convex side. The ligaments are contracted on the concave side and

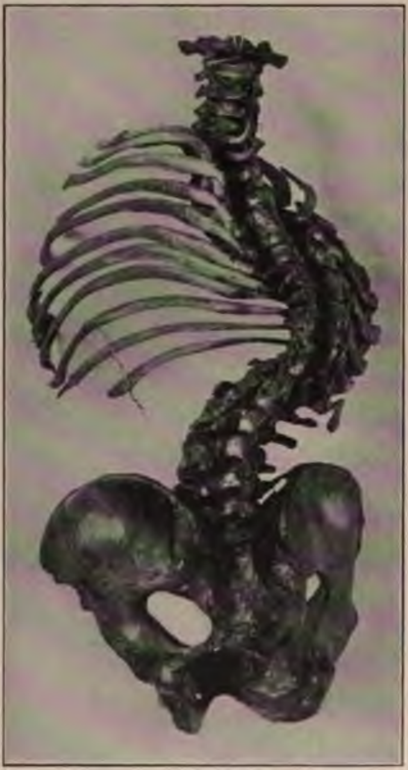

Fig. 7.—Showing curvature of spinal column in a typical case of scoliosis (Hendricks).

stretched on the convex. The lungs are compressed on the convex side, and the heart may be displaced toward the concavity. The stomach, liver, and intestines are displaced.

Symptoms.—There are very few symptoms aside from the deformity itself. As a rule, the deformity is first noticed by the mother or dressmaker. They will notice that one shoulder, usually the right, is unduly prominent, or that one hip, usually the left, seems to be much higher and larger than the other.

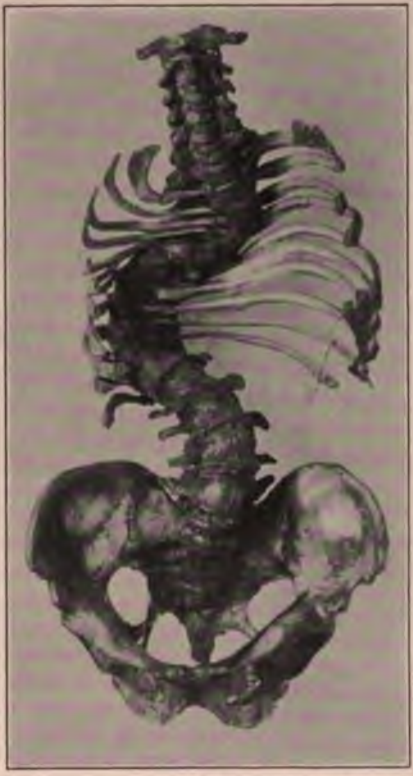

Fig. 8.—Showing changes in shape of the vertebræ in scoliosis (Hendricks).

For examination the patient should be stripped and made to stand erect, with the back toward the examiner and the arms hanging loosely by the sides. (See Fig. 3.) In scoliosis the one shoulder will be unduly prominent, and the lower angle of the scapula will be tilted out from the body, making the so-called angel wing. On the side where the shoulder projects, the space between the elbow and the side will be found larger than the corresponding space on the other side. On the opposite side the arm may lie close to the body throughout its whole length, entirely obliterating the natural space between them. In a well-marked case the ribs not only project unduly to one side, but they project backward on the same side. The spinous processes can not be taken as an index to the amount of the deformity, because they may make almost a straight line when there is quite a well-marked lateral flexion, for as the spine bends laterally, the vertebræ rotate upon one another in such a manner as to throw the bodies toward the convexity, leaving the spines at or near the median line. This rotation is the most serious part of the deformity.

If the patient now be made to face the examiner, the side corresponding to the convexity of the deformity will be found flattened, and the mammary gland atrophied. The other shoulder will be down and the hip prominent.

Scoliosis does not cause a limp or a characteristic gait, except in very extreme cases. In beginning cases the spine is quite flexible, but in old or well-marked cases it becomes quite rigid.

Occasionally, in extreme cases, pain is a symptom. It is neuralgic in character, and is caused by pressure upon the nerves at the spinal foramina. The ribs and the crest of the ilium may come in contact in such a manner as to cause pain.

There are no characteristic complications, and the general health is not interfered with.

Rickets may co-exist with scoliosis, but does not stand in the relation of either cause or effect. The pelvis is not deformed except when rickets is present, and the cord does not suffer from pressure, no matter how severe the deformity.

Diagnosis.—Inspection is sufficient, as a rule, to establish the diagnosis. Rachitic curves are anteroposterior and are accompanied by other rachitic symptoms. Curves due to Pott's disease are anteroposterior in the vast majority of cases. In the few cases of lateral curvature from Pott's disease, the peculiar gait, attitude, and pain will establish the diagnosis. Malignant disease may cause a lateral curvature, but it will be accompanied by very severe pain and early paralysis, and the patient will be very ill.

Prognosis.—The majority of cases of scoliosis are known only to the mother and the dressmaker, since they are slight and have very little, if any, tendency to increase. The prognosis in those cases coming under the notice of the surgeon depends largely upon the stage in which it is found. If the deformity is in the early or forming stage, there is a good chance of preventing an increase, and some prospect of overcoming existing deformity. In the second or progressive stage, the chances of preventing an increase of deformity are not so good, and the chances of overcoming existing deformity

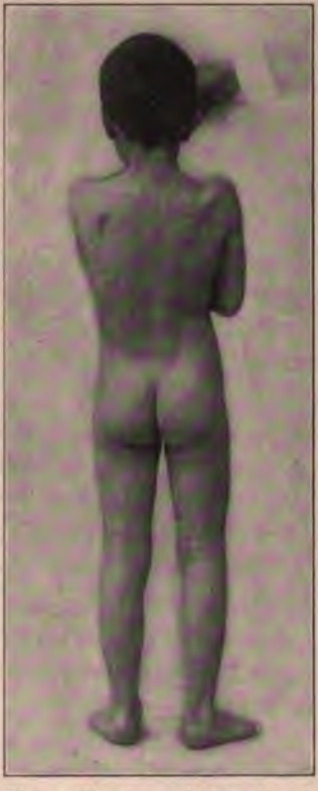

Fig. 9.—Showing a lumbar lateral curvature at very early stage.

are almost *nil.* In the last or fixation stage nothing can be done, as a rule.

Treatment.—The treatment of scoliosis is, on the whole, about the most unsatisfactory part of an orthopedist's work, because, as a rule, the deformity is well established before the patient is brought to him. The deformity is all the patient complains of, and it is very rarely indeed that one is safe in promising to relieve him of it. The natural tendency is to apply some variety of brace for the cure of this deformity, but after several years' experience the writer is prepared to state very emphatically that this kind of treatment is, in the vast majority of cases, worse than useless. Any amount of pressure that could be expected to be of value can not be borne by the patient. Much pain, discomfort, and disappointment have been caused in these cases by braces, with no corresponding benefit. In a few exceptional cases, where the deformity is increasing very rapidly, mechanical support can be worn to advantage. These cases occur in young women who have soft bones, soft, flabby muscles, and who are growing tall very rapidly. In such cases it is well to make use of proper mechanical support until the bones and muscles have gained firmness and strength enough to do their work, and the patient has grown about as tall as she is likely to.

Steel supports have proven very inefficient in the writer's hands. Some variety of close-fitting jacket has proven much more satisfactory. This jacket may be made of leather, paper, wood, or plaster-of-Paris. The plaster has the advantages of being always at hand and being easy of application. So long as the patient can be near the surgeon the plaster is best, because it can be changed as often as is necessary, and can be made to fit every time. Any other material will either be more expensive and troublesome, or will soon get to fit badly, owing to the rapid change in shape taking place in the patient. (For method of applying plaster jacket see treatment of Pott's disease.)

For patients who live at a distance, the plaster is not so reliable as the other varieties of jacket. For this class of cases the writer has been best pleased with loop leather. This leather is used by harness-makers to make loops, and is quite extensively used by artificial-limb makers. It is prepared by a special tanning process, so that after it is once molded into a certain shape it will retain that shape indefinitely. It is lighter than sole leather, and can be readily molded into the desired shape when it is wet.

To make a loop-leather jacket, it is necessary to have a model of the body to fit it upon. This model is easiest made by applying a neat-fitting plaster-of-Paris jacket, and removing it by cutting it down in front. The jacket is held together by bandages or adhesive plaster, and is used as a mold, which is to be filled with plaster-of-Paris paste to procure the model.

When the surgeon has no one to prepare the corset for him, he can prepare it himself, for it is a comparatively simple matter to mold the leather over the model. The writer makes the original plaster jacket, and sends this to an artificial-limb maker, who makes the model and the corset. The leather should be freely perforated with holes for ventilation before it is applied to the mold. When the patient is quite heavy, it is advisable to rivet light strips of steel over the parts where the most strain will come ; but for children this is entirely unnecessary. A row of hooks should be fastened to each side of the anterior opening, for lacing.

This makes a very light and comfortable jacket, and one that will meet all the requirements. It may be lined with chamois and highly polished, so that it is really a thing of beauty, but this is unnecessary so far as its usefulness and comfort are concerned.

The same jacket may be made of sole leather when loop leather cannot be obtained, but it is heavier and not so durable as the loop leather.

The paper jacket, as made and recommended by Dr. Weigel, of Rochester, N. Y., and the wood corset, recommended by Dr. Phelps, are admirable appliances, and are to be highly recommended where a permanent jacket is required. Their only disadvantage is that they require special skill for their application that the average practitioner does not possess.

The writer wishes to emphasize the fact that jackets of any kind are indicated only in exceptional cases, and in them only until such time as the patient has gained strength and solidity enough to overcome the tendency to a very rapid increase of deformity. They are in no way curative, but, on the contrary, interfere with the normal, healthy action of the muscles of the body, which is so necessary for their development.

Fortunately, however, we have other methods of treatment at our command which offer much greater encouragement in properly-selected cases. It is very generally accepted now among orthopedists that gymnastics, with or without electricity and massage, afford the most satisfactory results in the treatment of scoliosis. With this treatment many beginning cases can be cured, and many more advanced cases can be improved or arrested.

When a case of scoliosis is taken for treatment, it is wise for the attendant to explain to the parents that the treatment, to be of any value, must be kept up for many months, or possibly for years, and that while positive results cannot be promised, some cases are cured, and most cases are benefited, and that without treatment the deformity has no tendency whatever to improve. Fortunately for orthopedists, when the case is thus honestly explained, most parents are very well satisfied if an increase of deformity is prevented. They are so anxious to have their child improve that they are often easily imposed upon, and are ready to believe that improvement is taking place when it is evident to the surgeon that the reverse is true. This fact is taken advantage of by " mind-cures," "Christian scientists," " osteopathists," and other frauds, to their financial advantage.

It is quite important to keep an exact record of the amount of deformity at the beginning of treatment, and at various stages of the treatment. A number of machines have been invented for making these records, but the best method is to have a series of photographs taken.

In the treatment of these cases, it is very important to overcome all habits that have a tendency to increase the deformity. If the child is attending school, faulty positions while sitting and standing must be overcome. The manner of carrying the school-books should be observed, and, if faulty, must be corrected. It stands to reason that when treatment is kept up for only a few minutes each day, it can be more than counterbalanced by faulty positions maintained for hours each day.

Roth has had much to do with the development of this modern treatment of scoliosis, and the principles advocated by him have been well stated in an article by Dr. Reginald Sayre, in the *New York Medical Journal*, November, 1888, in the following language: " In beginning the exercise, a mat or thick shawl is laid upon the floor, and the patient lies prone, the arms at right angles to the trunk, palms down, face turned to the convex side, and the back as straight as possible (Fig. 10). The patient supinates the hands, throws the scapulæ well back, raises the hands from the floor, and lifts the trunk, while the surgeon holds the feet down. This is repeated three times; later on it may be done oftener. The breath should not be held during any of these exercises, but the patient should breathe naturally. If necessary, to secure this make her count out loud while exercising.

" With the hands raised behind the head, the patient raises the elbows from the floor, and raises the trunk as before, the feet being held by the surgeon.

" With the hands behind the head and the elbows raised, the body is swayed toward the convex side, the patient trying to 'pucker in' the bulging ribs and not to bend in the lumbar concavity. The feet are fixed as before.

"With the arm on the side of the convexity under the body, the other arm over the head, the heels fixed, the patient raises the trunk from the floor.

"Sometimes the arm on the side of the concavity is put on the opposite buttock, while the patient raises the trunk. Sometimes the arm on the convex side is put on the buttock, and in cases of marked lordosis, with marked stooping of the shoulders, both hands are put on the buttocks while the patient raises the trunk.

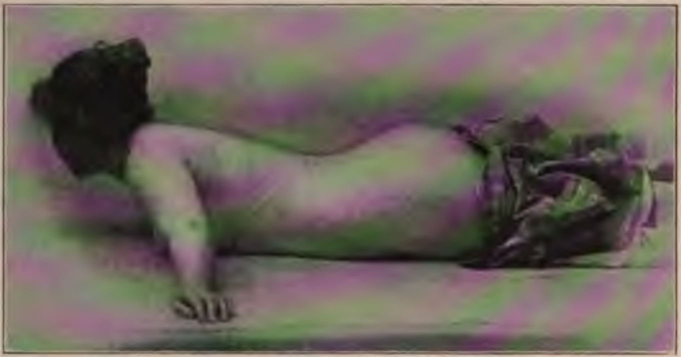

Fig. 10.—First position in treatment by gymnastics.

"The patient now lies on the back, arms at the side, palms up, and lifts first one foot in the air while the surgeon makes resistance graduated to the patient's power; repeated, say, five times. The same is done with the other foot, and then with both. The feet are next separated, and then brought together once more, while the surgeon resists. Each leg then describes a circle, first from within out, and then from without in. If there is special weakness at the ankles, with a tendency to flat-foot, the patient flexes the foot and extends it against resistance, and turns the sole of the foot toward its neighbor, the surgeon resisting;

it is then forcibly everted again by the surgeon, the patient resisting.

"The patient now lifts the arms from the sides, passing perpendicularly to the floor until they are stretched as far beyond the head as possible, and then, going at right angles to the trunk and parallel with the floor, returns them to the sides, palms up. While the heels are held, the patient rises to a sitting position, hands at the sides; then she rises from the floor with the hands behind the head and the elbows at right angles to the trunk.

"The patient now stands with the heels together; toes turned slightly out, hands behind the head, elbows at right angles to the trunk; then rises on tiptoe, bends the knees and hips, keeping the back as straight and erect as possible, and rises up once more. With the arm on the concave side high above the head, the arm on the convex side at right angles to the body, she rises on tiptoe, bends the hips, knees, and ankles so as to squat, then rises and stands. All this time care must be taken to push the body as straight as possible, and gradually educate the patient to hold it so, without wriggling during these movements.

"Let the patient practise walking in these positions, both on the flat foot and tiptoe, and also step high, as if walking upstairs. With the palm of the patient's hand on the convex side against the ribs, pushing them in, with the hand on the concave side she pushes a slight weight up in the air, while the body swings so as to straighten out the curves.

"Sit behind the patient, fix her thighs with your knees while she holds both arms above the head and bows toward the floor, keeping her knees stiff, while you keep her ribs as straight as possible with your hands.

"With the arm on the concave side across the top of the head, and the arm of the convex side around in front of the abdomen, the patient bends to the convex side, through the ribs and not through the waist.

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"The patient sitting with the back toward the surgeon, the latter pushes one hand against the most prominent part of the convexity, and with the other hand passed around the shoulder of the concave side, straightens out the curve as much as possible, the hand on the 'bulge' acting as a fulcrum in straightening the curve.

"The patient sits on a stool in front of the surgeon, who fixes the pelvis with his knees. The patient then twists the projecting shoulder to the front, while the surgeon holds the elbows, which are at a right angle to the trunk, the hands behind the back, and makes resistance. In the same position, the patient swings forward and backward, swinging through the hips, keeping the back stiff and not bending the waist.

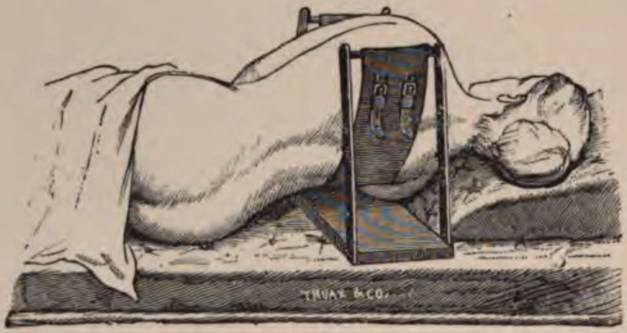

Fig. 11.—Cradle for treating scoliosis.

"The patient pushes the ribs on the convex side with the hand, and pushes up with the hand on the concave side, the same as when standing. The patient also lifts the arm of the concave side at right angles with the body while holding a weight."

Patients may be taught to assume certain postures at regular intervals, retaining the position as long as possible each time (Figs. 11 and 12).

Each patient who is old enough to carry out instructions should have a gymnasium of his own. Some one of the various exercise machines is a good thing to have in the patient's bedroom. The weight and pulley machine, or the one with rubber cords, affords good exercise. A trapeze and a horizontal bar are valuable. An apparatus for self-suspension is much better than the horizontal bar, because swinging by the arms develops the arm muscles much more than those of the trunk (Fig. 13).

Patients who tire easily should be instructed to lie down frequently in such a position as to overcome the deformity as much as possible.

Another important method of treatment is mechanical correction by means of a machine by which heavy pressure can be made. The writer has been greatly pleased with the machine originally invented by Schede and modified by Weigel and others (Fig. 14). With this machine it is certain that some cases can be greatly benefited that would not yield to gymnastics alone. Mild cases can be treated successfully by this method, but it will fail, like all other treatment, in severe cases. It is in these middle-grade cases, in which it is an open question how much good you are going to accomplish, that this machine is the greatest help. It would be a great mistake in any promising case

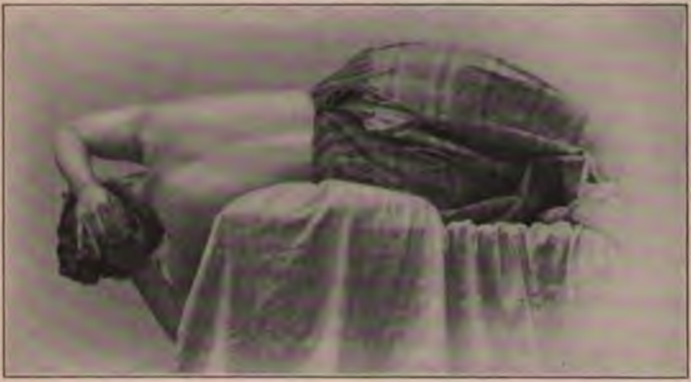

Fig. 12.—Posture treatment over end of couch.

to omit the gymnastic exercises because the machine was being used. The writer has been able to do some good by this method, in the way of relieving pain in old, fixed cases, where relief from deformity is not to be expected, by applying force, to the limit of the patient's endurance, in the direction that would have a tendency to overcome the deformity.

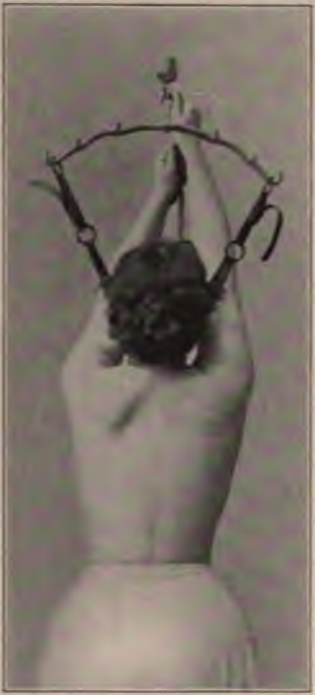
Fig. 13.—Apparatus for self-suspension.

The machine is to be used in each case upon about the same rule as gymnastics in point of frequency. In cases in which the tendency is toward a rapid increase of deformity, the patient should be treated every day, and in others, where this tendency is not so marked, three or four times a week will be sufficient. No special directions need be given as to how to apply the pressure. It is sufficient to say that the various pads and screws must be so adjusted as to apply the force so that it will untwist the back. The pelvis must be fixed, and the suspension applied; then strong pressure must be made upon the greatest convexity, with counterpressure at suitable points. At first the amount of pressure must be light, and the time not over five minutes. The pressure can be gradually increased and the time lengthened as the patient becomes accustomed to it. It is really astonishing what an amount of pressure can be borne with comfort after a time. The time cannot well be extended to over twenty or thirty minutes. The machine

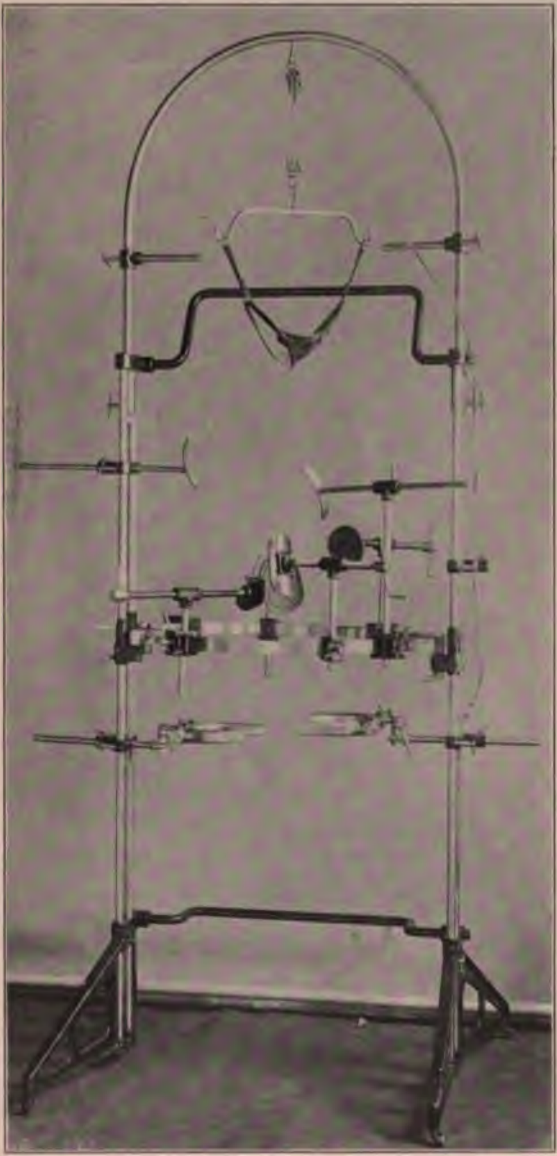

FIG. 14.—Apparatus for forcibly correcting scoliosis.

must not be made an instrument of torture, because that is neither necessary nor advisable. In the writer's experience, patients have not complained of the slightest discomfort. This, like any other treatment for scoliosis, must be kept up for a long time.

CHAPTER IV.

TORTICOLLIS (WRY-NECK).

TORTICOLLIS is a deformity of the neck in which the head is drawn down toward one shoulder and the face turned in the opposite direction (Figs. 15, 16, 17).

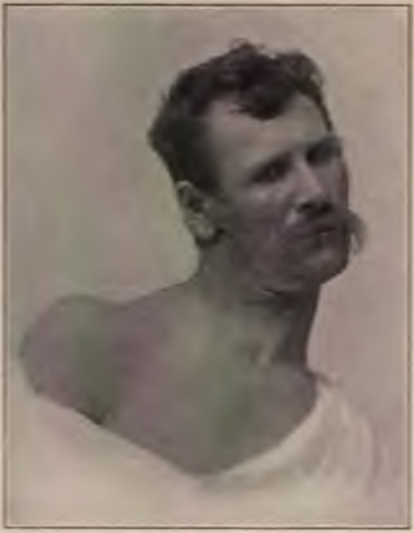

Fig. 15.—Torticollis.

Etiology.—The disease is usually one of childhood, although it occasionally appears in adults. Most authors state that it occurs more frequently in males than in females, but of 264 cases reported by Whitman, 155 were in females and only 108 in males. It occurs most frequently on the right side. It may be congenital or acquired; the majority of cases are acquired. Of those classed as congenital, many are doubtless due to injuries occurring at birth. These injuries may be to muscles, nerves, or nerve centers.

Acquired cases may be traumatic, paralytic, compensatory, cicatricial, spasmodic, idiopathic.

Many traumatic cases have their origin at the time of birth; the muscles may be torn, bones may be broken or distorted, nerves or nerve centers may be injured.

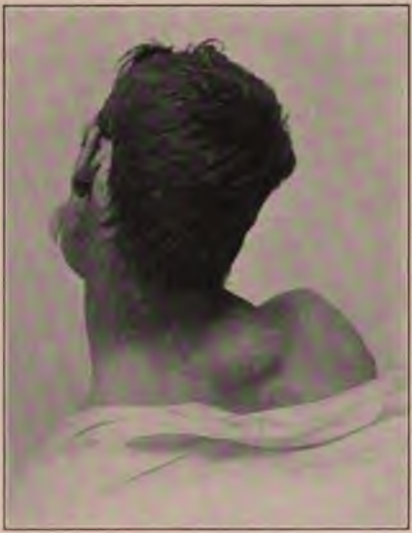

Fig. 16.—Torticollis.

Paralytic cases are very rare, because paralysis affecting these parts is rarely confined to those muscles the loss of which would cause this deformity. When it does occur, it may be due either to central or peripheral causes.

Compensatory torticollis may occur in scoliosis. It has been known to occur on account of a defect in the eyes. Bradford reports a case in which the child's eyes were so placed that he found it necessary to twist his neck in order to secure binocular vision.*

Torticollis may be caused by cicatrices following burns, scalds, injuries, and lupus, or by suppurating cervical glands.

Spasmodic or spastic cases may be due to either a central or peripheral lesion. This variety occurs in adults, and may be the result of a general nervous condition like hysteria, or it may be due to a grave central condition.

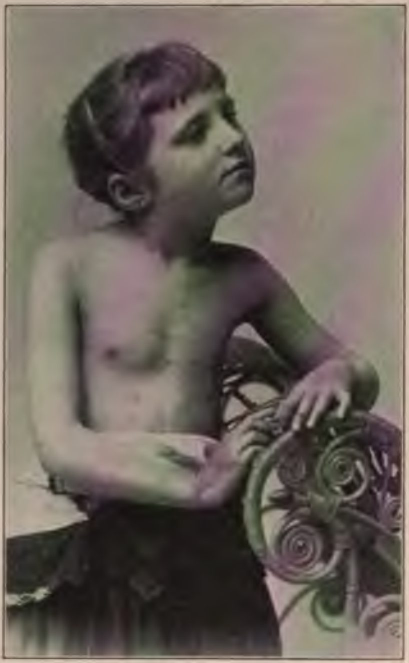

Fig. 17.—Congenital torticollis.

Cases of intermittent torticollis have been reported that were due to malaria.

The so-called idiopathic cases are, of course, due to causes we do not fully understand. It has been pretty generally believed that many cases are due to an injury to the muscle at childbirth, causing a hematoma, which is followed by contraction. Whitman denies that hematoma is followed by torticollis, and reports a series of cases to prove that this theory as to cause is not borne out by facts.* Under the head of idiopathic cases may also be classed some cases accompanied by or due to a general nervous condition, the cause of which is not apparent.

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* See "Transactions American Orthopedic Association," vol. i, p. 46.

Pathologic Anatomy.—Torticollis is not a disease, but is a symptom of a number of different diseased conditions, so it cannot be said to have a definite pathology of its own; but a series of anatomic changes occur that are worthy of note. The contracted muscles are hard and fibrous. The bones and cartilages in extreme chronic cases may be changed by pressure atrophy, as in scoliosis. The ligaments become stretched on the convex side and contracted on the concave side. The muscular shortening is the essential feature of this deformity, all other local changes being secondary. In this it differs very materially from scoliosis. The sternocleidomastoid, trapezius, splenius, and scalena muscles are the ones most frequently involved. The spinal accessory nerve is usually involved, either at its center or periphery.

Symptoms.—Torticollis may be either acute or chronic. The acute variety may become chronic. It may be either permanent or intermittent. The position varies, but in the majority of cases the face is turned away from the contracting muscle and slightly upward. In chronic cases the face on the contracted side becomes atrophied, and the angle of the nose with the eye is changed. The skull may also be asymmetric.

The acute variety may be due to an inflammation in the muscle, and may then be accompanied by slight pain and temperature. Ordinarily, however, pain or temperature are not symptoms of torticollis.

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* See "Transactions American Orthopedic Association," vol. iv, p. 293.

The intermittent variety occurs in adults, and is usually posterior. It may be almost constant or only occasional. The spasm is usually clonic, but may become tonic. Figures 15 and 16 were taken from a case of spasmodic torticollis in which the writer removed a section of the spinal accessory nerve. After the operation, the extreme spasm was relieved, and the patient was no longer obliged to support his head with his hand as he had done for years, but his neck remained crooked as before.

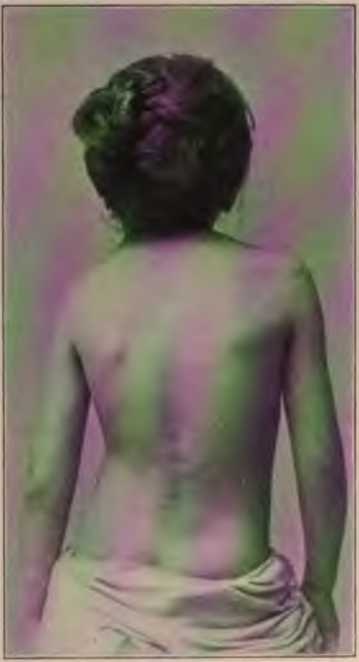

Fig. 18.—Curvature of spine, due to torticollis.

Diagnosis.—Inspection is usually sufficient to establish the diagnosis, since the turning of the face sidewise and upward without accompanying pain or tenderness does not belong to the history of any other affection. In every case, however,—more especially in posterior deformity, where force may be used in treatment,—a thorough examination should be made to exclude Pott's disease.

In torticollis, the contracted muscle or muscles can be clearly traced by palpation, and no soreness will be found. Except in marked spasmodic cases, the patient will make no effort to support his head with his hands.

In Pott's disease, the patient usually complains of pain, and in all cases pain can be elicited by manipulation. The patient often supports his head with his hands, and characteristic muscular spasm is present. He is apt to walk in the careful manner characteristic of Pott's disease. A very important differential point is that, while in torticollis the face will be turned away from the contracting muscle, in Pott's disease it is turned toward it (compare Figs. 17 and 24).

A cervical abscess will be accompanied by temperature and the other characteristic symptoms of abscess. Enlarged glands can be found by palpation.

Prognosis.—The prognosis in torticollis, under proper treatment, is favorable. A certain number of acute cases, due to an inflammation of the muscle or to hysteria, have a tendency to recover in a short time, even without treatment. Some of these cases, however, become chronic. Aside from the cases just mentioned, torticollis has little tendency toward recovery without proper treatment.

Treatment.—The treatment of torticollis is medical, mechanical, and operative. In those varieties just mentioned, in which the natural tendency is toward recovery, medical treatment may be helpful, but there is no special medication to be recommended. Indications are to be met as they arise in this as in any other affection. The bowels should be regulated, tonics given to anemic persons, etc.

The very fact that so many medicines have been recommended for torticollis is evidence that they are all disappointing.

Mechanical treatment may be successful in a very mild case, but in a well-marked chronic case it will fail, unless it is preceded by proper operative procedures.

In paralytic cases mechanical treatment is indicated.

The proper treatment in the majority of cases of torticollis is an operation, followed by mechanical treatment. Neither the operation nor the mechanical treatment alone is sufficient, as a rule; but combined, they are eminently satisfactory.

When the sternocleidomastoid is contracted, it should be cut, either by subcutaneous tenotomy or by open incision. Under proper aseptic precautions the open incision is the better and safer operation. Tenotomy is a comparatively simple procedure, but has been followed by fatal hemorrhage. The tenotomy is best performed a short distance above the clavicle. The sternal and clavicular attachments should be cut separately. If the external jugular vein cannot be seen, slight pressure should be made at the lower end of the neck, to make it visible, for it is to be carefully avoided. The tenotome should be introduced between the two heads of the muscle, about ½ to ¾ of an inch above the clavicle, and passed flat-wise close in under the clavicular attachment; its edge is then turned toward the surface and the muscle cut through with a gentle sawing motion. The instrument should then be withdrawn, and again introduced at or near the same point, and passed forward beneath the sternal end, exercising great care to hug the muscle closely, so as to avoid the underlying blood-vessels. The internal jugular has been punctured by allowing the point of the knife to sink too deep into the neck. In the effort to keep close to the muscle it should not be pierced with the tenotome, for this will leave some fibers uncut.

After having severed both heads of the muscle, an aseptic pad and bandage should be applied, and the head put in a slightly overcorrected position, and held there by a proper mechanical apparatus.

The writer is very strongly in favor of the open incision in these cases, because by it the operator sees just what he is cutting, and if he should be so unfortunate as to cut some good-sized blood-vessel he is in a position to tie it. The only objection that can be raised to it is the possibility of its being followed by a scar. When the work is done aseptically, as it always should be, the scar is very slight, and after a time can hardly be found.

The incision is best made along the anterior border of the muscle, and should be about 2½ to three inches long. The muscle is exposed, taking special care not to open the deep cervical fascia, and a grooved director carefully passed between it and the blood-vessels, at a point about one or 1½ inches above the clavicle. The muscle is then cut across, and any bleeding points secured and tied with catgut. The wound is then closed and a surgical dressing applied.

A transverse incision has been recommended, but is more likely to be followed by a scar.

After this operation, the head should be placed in an overcorrected position and kept there for two weeks, by some fixed dressing. Plaster-of-Paris is a favorite with the writer. A silicate bandage or some steel appliance may be used, but they are not so convenient as plaster. The plaster bandage should be applied before the patient awakes from the anesthetic. It should be applied over the surgical dressing, and be carefully molded to the shoulders, occiput, and inferior maxilla, so as to hold the head in the overcorrected position.

After the first two weeks it will not be necessary to keep the head in the overcorrected position, but mechanical support should be worn for some weeks or months, according to the severity of the case. In a very young patient or in a mild case, four or six weeks will be long enough to wear the appliance, but in severe cases it will be necessary to wear it as many months. The apparatus should simply hold the head in the normal position to prevent a relapse.

For cases requiring short treatment, the plaster collar will answer every purpose, but for longer cases some other variety of apparatus will be more elegant. A collar of leather, properly molded, answers the purpose admirably (see Fig. 25). For the original dressing and for mild cases, a band of adhesive plaster may be applied around the head, another around the body, and a third connecting the two in such a manner as to hold the head in the desired position.

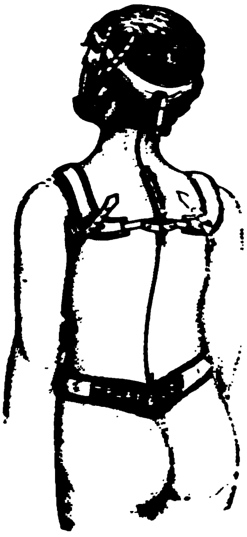

FIG. 19.—Markoe's brace for torticollis.

Quite a variety of steel braces for torticollis have been invented, but most of them were intended for use when mechanical treatment alone was employed. When that was the treatment in vogue, it was only by protracted treatment that anything could be hoped for, and even that often resulted in disappointment. For such protracted treatment elaborate apparatus was a necessity, but with modern operative treatment the mechanical treatment is comparatively short, and a very simple appliance will suffice.

Most of the steel braces consist of a waist band and two uprights, similar to those used for Pott's disease, to which is attached a head-piece. The head-piece may be a simple support underneath the chin and occiput, or it may be more elaborate, having attachments for grasping the head, and screws for changing the position. Figure 19 illustrates a very simple and efficient brace.

In intermittent and spasmodic torticollis, nerve section has been followed by some very satisfactory results. The muscles involved in these cases are those supplied by the spinal accessory nerve, and this is the nerve requiring section. It has been found that simple section of the nerve is followed by only temporary relief, because the nerve-ends unite, and the cases relapse. Permanent relief, however, can be had by removing a portion of the nerve.

The nerve enters the muscle about 1½ inches below the mastoid process, and can be reached by an incision either at the anterior or at the posterior margin of the muscle. Most writers recommend the posterior incision, but there is really very little choice.

An incision about three inches long is made along the margin, and the muscle lifted up, when the nerve can be readily found. A piece of the nerve at least ½ of an inch long should now be removed, the wound closed up, and a surgical dressing applied.

These are very distressing cases, and almost anything offering relief should be tried. Nerve section under aseptic precautions is a very safe proceeding, and the paralysis following it is not a serious matter.

Posterior torticollis may sometimes be satisfactorily treated by forcible correction under anesthesia, without tenotomy. Cervical caries must be carefully excluded, because force applied in caries might be followed by a fatal result. Such cases have been reported. After forcible correction, the head must be held in an overcorrected position for a time, just as if a cutting operation had been performed.

CHAPTER V.

POTT'S DISEASE AND TYPHOID SPINE.

THE disease most commonly known as Pott's disease, but called also spondylitis, caries of the spine, and tuberculosis of the spine, was known to Hippocrates, but was first clearly described by Percival Pott in 1779. It is a destructive disease of the bodies of the vertebræ, and is now known to be tubercular in character. Delpech was the first to teach that it is tubercular, in 1816. Nélaton, wrote the first treatise on tuberculosis of bone in 1837.

Causes.—There is a pretty general belief that heredity acts as a very strong predisposing cause, but it is very certain that the disease often occurs in children of perfectly healthy parents. It occurs not infrequently as a sequel of the exanthemata and other diseases of childhood. It may occur at any age, but the large majority of cases occur in childhood. Sex seems to have but little bearing as to cause, since there are nearly an equal number of cases among boys and girls. Every surgeon knows of a certain number of cases like the following, in which a traumatism was clearly the exciting cause. F. H., age thirty-two, when in perfect health fell backward from the side of a box car upon which he was climbing, striking in a sitting position. He suffered pain and gradual loss of health from that time on, and in the course of a few months had a well-developed dorsal Pott's disease, from which he finally died.

Knowing that certain cases are caused by a traumatism, it is rational to believe that others are caused in the same way, although the history may not be complete. On the other hand, we must admit that the history of a traumatism, as given by the parents, is not always reliable, because they very generally believe that the disease is caused by an injury or from "catching cold," and will furnish a history accordingly. The mere fact that a child tumbled down stairs some time before the development of the disease is no proof that the fall was the cause of it.

The disease begins in the bodies of the vertebræ, very rarely extending to other parts of the bone, even as a secondary affection. The beginning is usually at one small spot, well toward the anterior surface of the body of the vertebra, but it may begin in more than one bone at the same time. Older writers believed that the disease began in the intervertebral cartilage, but this probably never occurs. The original seat of the disease is so uniformly at the point where the bone bears the weight of the body, that it is reasonable to believe that this may have something to do with causing it. This certainly is the part of the vertebra most likely to suffer a contusion. The disease is most active at the centers of growth of the bone. It is found when the disease begins at or near the surface of the vertebra, that suppuration is apt to be an early and prominent symptom, and when it begins toward the center, suppuration is less frequent. The surface of the bone is more frequently attacked in adults, and is followed by a large percentage of abscesses. In children the vast majority of cases begin in the center of the vertebra, and are consequently followed by a sharper kyphosis.

Pathology.—The bodies of the vertebræ are gradually changed into granulation tissue, which breaks down into cheesy debris. A sequestrum may be present. Before the bone is destroyed by the disease it may be so softened by a rarefying ostitis, which precedes the spread of the disease, as to yield to the pressure of the weight of the body, and allow an increase of deformity. The intervertebral disks are destroyed by pus or by granulation tissue. The breaking down of the bodies causes the characteristic deformity or kyphosis of Pott's disease. When but one bone is involved, the angle is very acute, and when several are involved it is much more obtuse ; but in any event the angle is more acute than in the deformity caused by any other disease of the spine. When suppuration occurs in the upper lumbar or lower dorsal regions, it usually forms a psoas abscess and follows along the tendon of the psoas muscle, appearing just below Poupart's ligament. In the cervical region, a retropharyngeal abscess is liable to form. Abscesses may approach the surface at any point along the spine. This disease occurs most frequently in the dorsal region, next in the lumbar, and is least frequent in the cervical region.

The ostitis frequently causes a spinal meningitis, which may cause paralysis from pressure upon the cord. This paralysis is rarely caused by pressure of bone or by myelitis, but is usually due to the thickening from inflammatory deposits in the meninges.

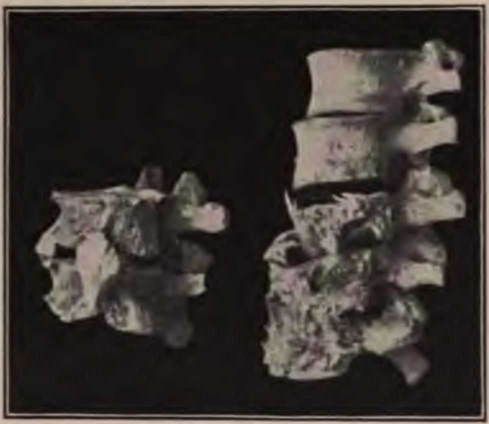

Fig. 20.—Showing frequent seat of disease in adults (Hendricks).

When recovery occurs, the diseased vertebræ are bound together by a new formation of bone, so that this part of the spine is permanently ankylosed (Fig. 21).

(For further details of pathology, see chapter xvi.)

Symptoms.—This disease usually begins in an insidious manner. The child will be less disposed to play than usual, and becomes stiff, and easily tired. This stiffness is more marked after the patient has rested for a time, and he limbers up with exercise. He will be restless at night, and after a time will begin to complain of pain. The pain is usually in the abdomen, and is very often attributed to indigestion. As a rule, the pain is subacute, but in some cases is very severe and very persistent. It is worse at night, and, when only moderate, may simply cause the child to be restless. Occasionally, night-cries occur in this disease, although they are less frequent than in tubercular arthritis.

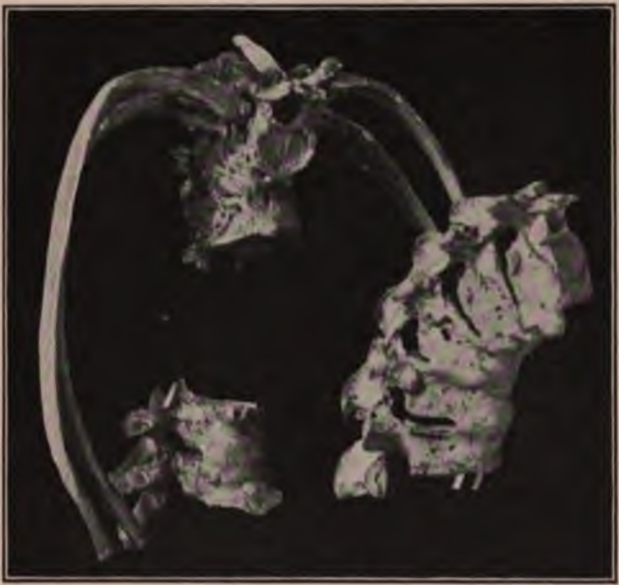

Fig. 21.—Showing ankylosis from Pott's disease (Hendricks).

In many cases the patient is first brought to the surgeon when the mother has noticed a deformity. The deformity is quite characteristic, and is often sufficient evidence upon which to base a diagnosis. It is at first a small knuckle, due to undue prominence of one spinous process. When the disease is confined to one or two vertebræ, the angle is very acute; when more bones are involved, the knuckle is not so sharp, and the deformity seems to be due more to a projection of several spinous processes than to the bending of the spine as a whole. The deformity is almost always a kyphosis or anteroposterior bending of the spine, although it occasionally is lateral. It is due to muscular action, and to a breaking down of the softened bodies of the vertebræ by the superincumbent weight. The bending forward is, of course, due to the fact that the transverse and spinous processes remain healthy, while the body breaks down.

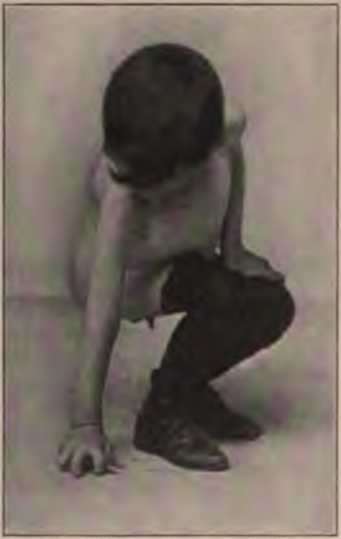

Fig. 22.—Showing stoop of Pott's disease.

As a rule, there are symptoms enough before the appearance of the deformity upon which a surgeon can base a diagnosis. Restricted motion is an early and constant symptom, and in this, as in tubercular arthritis, is the most reliable one upon which to base a diagnosis at an early period. It is doubtless caused by muscular spasm, and by an involuntary effort upon the part of the patient to keep the spine at rest.

This rigidity of the spine is manifest in almost every motion the child makes. He moves in a guarded way, as if he were afraid to move. When asked to pick some object from the floor, he will not stoop down, but will crouch down without bending the spine (Figs. 22 and 23). The gait is peculiar, owing to the stiff spine and the shuffling, careful way in which he moves his feet. In the later stages, the gait may be greatly modified by psoas contraction. When the disease is in the cervical region, torticollis is apt to be a symptom, and may be mistaken for a simple torticollis. The chin is elevated in a peculiar manner that can hardly be mistaken when once recognized. The patient frequently complains of a choking sensation and difficulty in swallowing. At times he may have an irritating cough, and a sensation as if a string were tied about his neck. The pain is apt to be felt in the thorax. When sitting down, the child will rest his elbows on the arms of his chair and support his head with his hands in a very characteristic

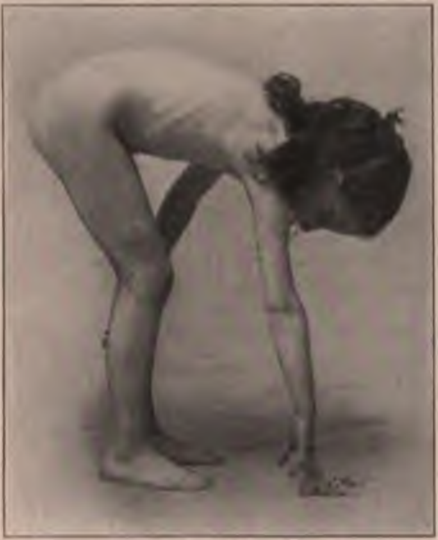

Fig. 23.—Stoop of healthy child.

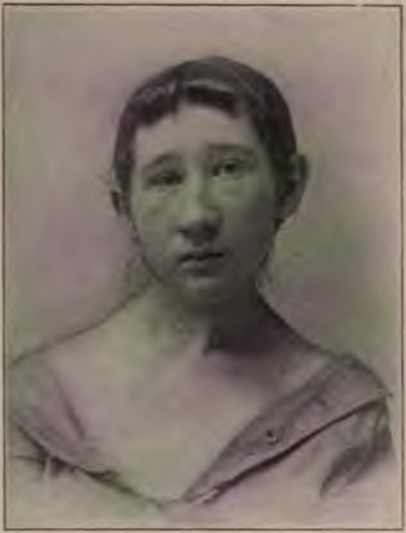

Fig. 24.—Cervical Pott's disease, resembling torticollis.

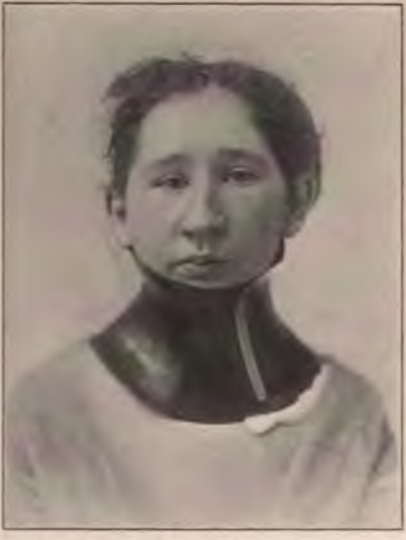

Fig. 25.—Leather collar for treating cervical Pott's disease.

manner. Cervical disease is very commonly located in the joint surfaces, between the atlas and axis. The odontoid process may be involved.

When the disease is in the dorsal region, the shoulders are elevated so that the neck seems to be shortened, and deformity occurs early (Fig. 26). The pain may be either in the thorax or in the abdomen. A train of dyspeptic symptoms is present, and is often treated for a long time before the real disease is suspected. The child becomes pot-bellied, and often complains of stomach-ache. He supports the weight of his body on his elbows when sitting,

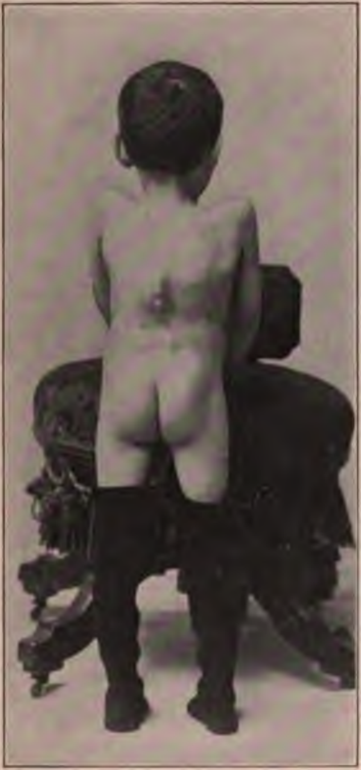

Fig. 26.—Dorsal Pott's disease.

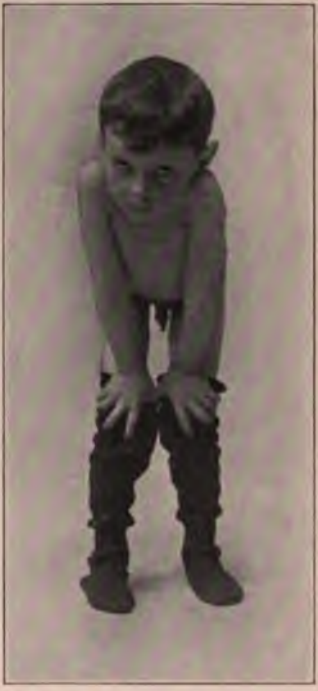

Fig. 27.—Characteristic position in dorsal Pott's disease.

and rests his hands upon his thighs when standing (Fig. 27). Paralysis of the lower extremities is an occasional symptom of the disease in this location. A peculiar grunting respiration is also to be observed.

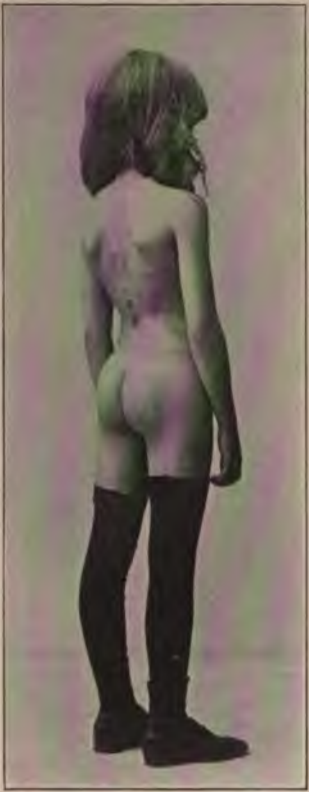

Fig. 28.—Lumbar Pott's disease. Lordosis.

In the lumbar region the deformity is a lordosis, or bending forward, and is caused by contraction of the psoas muscle (Fig. 28). The patient is obliged to throw his shoulders back in order to assume the upright position, making the appearance and the gait quite characteristic. The pain in lumbar disease may be in the abdomen, but is more likely to be in the lower extremities. The bladder and rectum may be irritable or painful. Constipation is apt to be present. Figure 29 illustrates an extreme deformity, caused by psoas contraction—the patient being obliged to walk upon "all fours."

Paralysis of the lower extremities is an occasional complication. In the upper extremities it very rarely occurs. In poorly treated cases paralysis is not infrequent, but in cases treated by proper mechanical support it is comparatively rare. It comes on gradually, being first manifested by weakness of the limbs, and gradually grows worse unless cut short by treatment. Paralysis of motion may be partial or complete. Anesthesia is seldom complete, and when it is so is a bad symptom, since it indicates extensive myelitis. This symptom is most frequent when the disease is in the dorsal region. Since the paralysis is due to secondary inflammation, and not to bony pressure, the amount of paralysis or its frequency is not proportionate to the degree of deformity. The reflexes are exaggerated. Ankle clonus is apt to be very marked. The muscles become soft and flabby from disease, but there are no trophic changes or loss of electrical reactions, except when the cervical or lumbar enlargement is affected.

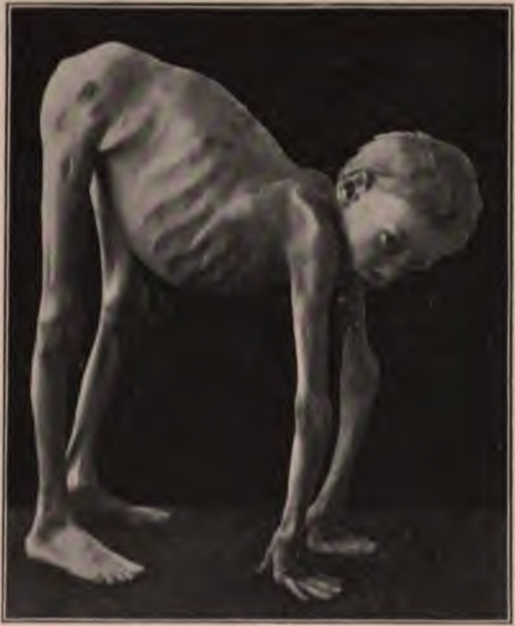

Fig. 29.—Dorso-lumbar Pott's disease. Extreme psoas contraction. Locomotion possible only upon "all fours."

The bladder and rectum are apt to be affected in all bad cases, and are sure to be when the lumbar enlargement is affected. The paralysis is almost invariably bilateral, and seldom develops before the second year of the disease. The prognosis is favorable, most cases recovering within a year, and very few lasting over three years. The recovery is complete, but relapses occasionally occur. Rigidity indicates secondary changes in the cord, and is an unfavorable symptom.

The general health is apt to be affected by this disease more than by tubercular arthritis, but in some cases, particularly in the lumbar region, the health is very little affected.

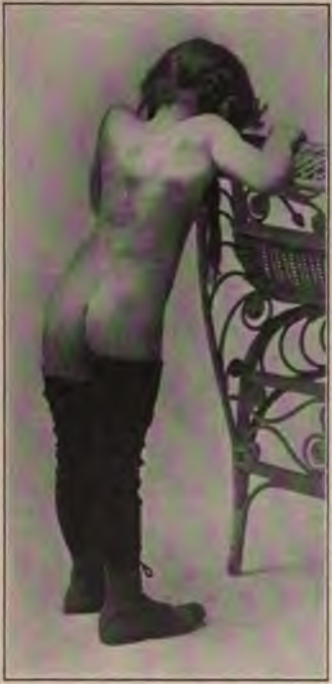

Fig. 30.—High dorsal Pott's disease. Recently recovered from paralysis.

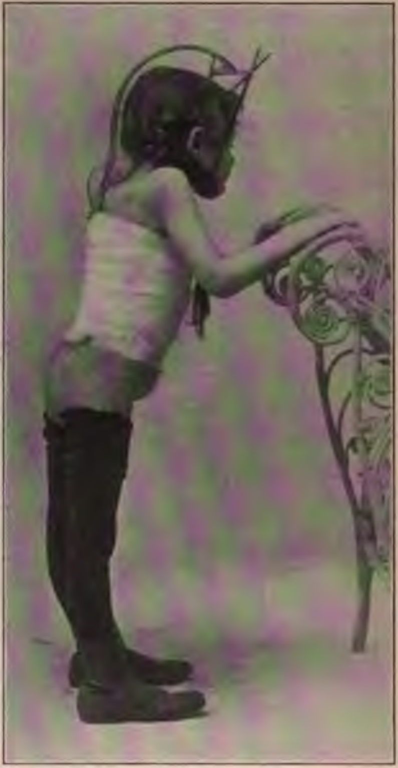

Fig. 31.—Jury-mast applied for high dorsal Pott's disease.

In a pretty large percentage of untreated cases of Pott's disease an abscess will appear; and in well-treated cases probably ten per cent. will develop abscess. In private practice, under favorable auspices, the percentage will naturally be less. This complication occurs more frequently, proportionately, in adults than in children, and it occurs most frequently when the disease is situated in the lumbar region, although it may occur in any region. In the cervical region it most frequently appears as a retropharyngeal abscess, and should always be suspected in cervical Pott's disease when there is unusual interference with swallowing and respiration. Abscess may appear in the side of the neck, particularly in the lower triangle.

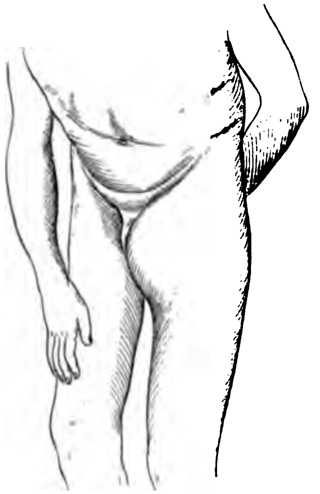
Fig. 32.—Psoas abscess (Hoffa).

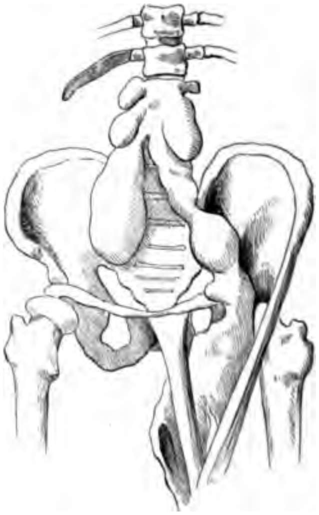
Fig. 33.—Dissection of lumbar and psoas abscess (Hoffa).

Abscess may develop with disease of any part of the dorsal region, and in the vast majority of cases appears either as a psoas, iliac, or lumbar abscess. The psoas abscess appears in the upper part of the thigh, just below Poupart's ligament, in Scarpa's triangle, and is so rarely due to any other cause that it may almost be considered pathognomonic of spinal tuberculosis (Fig. 32). Iliac abscess appears in the iliac region, just above Poupart's ligament.

It is just the same as a psoas abscess, save that it has not yet pushed its way underneath the ligament. The abscesses appear at points so remote from the seat of the disease because they follow the direction in which there is least resistance, which is along the fascia surrounding the psoas muscle.

Lumbar abscess may be a symptom of dorsal disease, but usually accompanies lumbar disease. It makes its appearance just outside of the quadratus lumborum (Fig. 34).

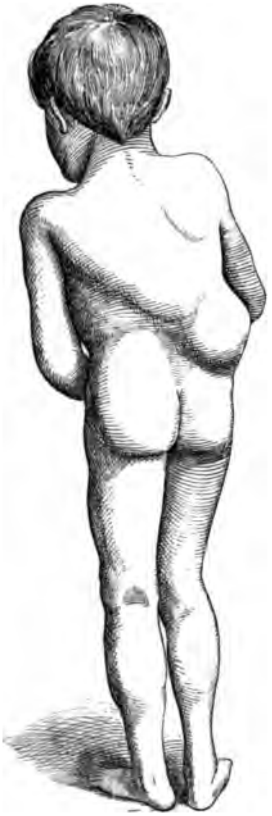

Fig. 34.—Lumbar abscess (Hoffa).

Occasionally the development of a tubercular abscess is so insidious that its appearance is the first intimation of the existence of a serious disease. It is apt to come on some time after the disease is well established, and its development is usually preceded by an increase of pain and disability. The general health is apt to be somewhat affected, although it is astonishing what a large abscess will sometimes develop without serious disturbance.

Strictly speaking, they can rarely be called abscesses, since they contain no pyogenic germs and the contents are different from other abscesses. The pus, so-called, may vary from a pale, straw-colored liquid to a thick, cheesy mass. Necrosed bone is sometimes found in these abscess-cavities. In rare instances these cold abscesses break into some cavity or viscus, causing speedy death.

Diagnosis.—A diagnosis of Pott's disease must be based upon rigidity of the spine, pain, attitude, gait, deformity, and sometimes upon abscess and paralysis. The first four trains of symptoms here mentioned are quite uniformly present. Deformity always appears after a time, and abscess or paralysis may come on late in any case. When the disease is in the lower dorsal or lumbar regions, psoas spasm is a very valuable diagnostic symptom.

When a child shows an indisposition to play as usual, complains of pain in the abdomen, and shows some peculiarity in his gait, his spine should be carefully examined; he should be stripped, and made to walk to and from the examiner, so that he may observe the gait. At a very early period the only noticeable change will be that he moves carefully and holds the spine rigid. Later, if the disease is in the lumbar region, he will throw his shoulders back and his abdomen forward, and step forward slowly, with the knees slightly bent, so as to have some spring in them; if in the dorsal region, he will step in the same careful manner, but will stoop forward; and if in the cervical region, he will elevate the chin and walk with the greatest care. The deformity appears quite early in this disease, and when present is almost enough evidence upon which to base a diagnosis; but it is very necessary to make the diagnosis earlier, so as to prevent deformity. Restriction of motion is the symptom of greatest value in making an early diagnosis in this disease, just as it is in tubercular arthritis.

Some object should be placed upon the floor and the child asked to pick it up. If the trouble is in the lumbar or dorsal region, instead of stooping over and picking it up, as a healthy child would, he will hold the spine rigid and get down by bending the knees and hips (see Fig. 22). He should now be laid prone upon a table, and the surgeon should take hold of his ankles and lift the limbs from the table in such a manner as to hyperextend the spine (Fig. 35). When disease is present, the spine will be rigid and will not bend backward, as in health (Fig. 36). With the patient still lying face downward, the legs should be taken one at a time and flexed upon the thigh, so that the sole is turned directly upward; the ankle should then be grasped by the hand of the surgeon and an effort gently made to hyperextend the thigh by lifting it from the table (Fig. 37). If disease be present in the lower dorsal or lumbar regions, a spasmodic jerking of the muscles will be felt. This is known among orthopedists as psoas spasm, and is due to spasm of the psoas muscle when put upon the stretch. Flexion of the thigh is often present, and is due to contraction of the psoas muscle. It may be on one side, or on both (see Fig. 29). We have this spasm and contraction because this muscle has its origin at the seat of the disease. The patient will often have a peculiar grunting respiration

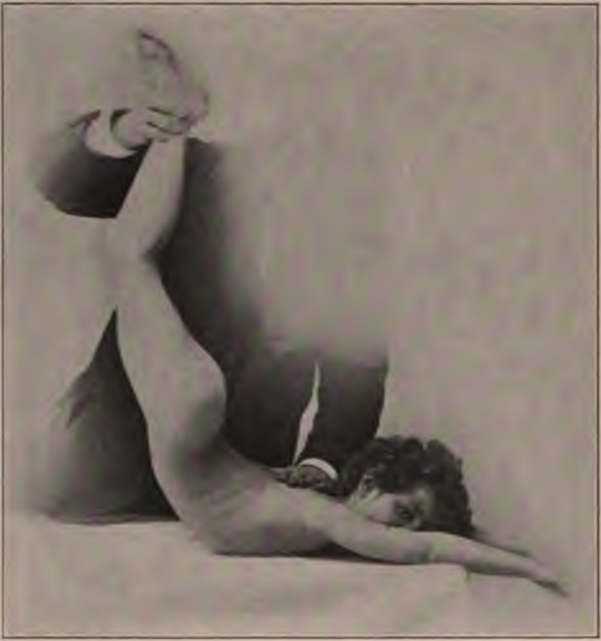

Fig. 35.—Curvature of healthy spine.

that is quite characteristic. The pain is also characteristic, and often the first symptom suggestive of this disease. There is nothing else among diseases of childhood that will cause such persistent pain in the abdomen. Little ones will often speak of it as a "stomach-ache" or a "belly-ache."

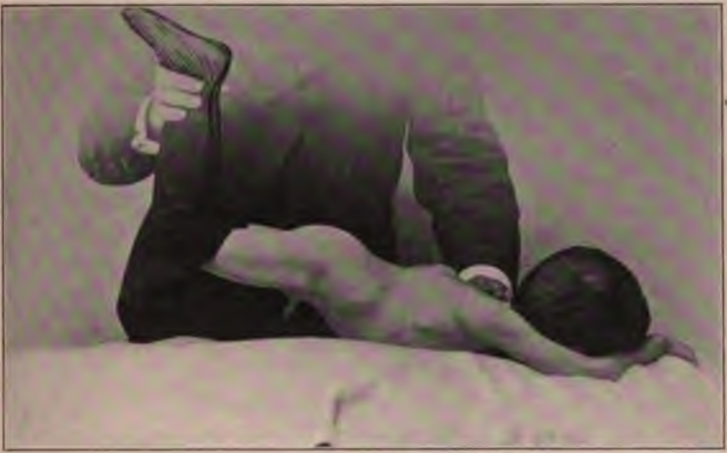

Fig. 36.—Showing rigidity of spine.

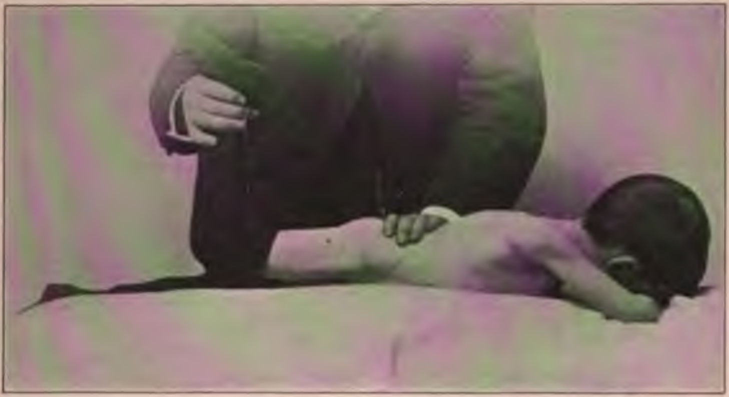

Fig. 37.—Testing for psoas contraction.

The deformity begins early and is quite distinctive.

It is, in the vast majority of cases, an anteroposterior deformity, with a sharper angle than that caused by any other disease. This fact is sufficient to differentiate it from scoliosis. Scoliosis and Pott's disease do not co-exist. The deformity of Pott's disease cannot be overcome by posture or manipulation. It is to be differentiated from the deformity of rickets by the fact that the rachitic deformity can be wholly or partly overcome by posture and manipulation, and by the presence of other characteristic deformities in rickets. The child may have the peculiar conformation of the chest known as "pigeon breast" in both of these diseases. The spinal deformity in rickets is apt to involve a much larger portion of the spine than in Pott's disease, and, instead of being an acute angle, is a long curve. It is well to remember that the sixth and seventh cervical and sometimes the last dorsal spine project normally. In old cases of Pott's disease the deformity is longer and more rounded than in more recent cases.

If, in the course of the disease, there is a decided increase of pain, it is apt to indicate the formation of an abscess. Abscess is to be diagnosed from tumors and herniæ. The location, together with the deformity and other symptoms of Pott's disease, should establish the diagnosis. A hernia would be in the inguinal or femoral canal. It would probably be reducible, and if composed of bowel would give tympanitic resonance, and would not give fluctuation. It should be remembered that nothing is to be learned from palpation of the deformity, because the disease is in the front of the vertebræ.

In neuromimesis of the spine, the patient will complain of excruciating pain upon pressure over the spinous processes.

A patient may be bedridden from weakness due to this disease, when no paralysis exists. The paralysis, coming late as it does, can usually be differentiated from paralysis from other causes by the presence of the deformity. The reflexes are exaggerated and ankle clonus is present.

Malignant disease of the spine is to be diagnosed by the severe and persistent pain, accompanied by an early development of paralysis. The patient with malignant disease shows that he is very ill.

Cervical tuberculosis may be mistaken for wry-neck. In Pott's disease the muscles in the back of the neck are most affected, while in wry-neck it is the sternomastoid. In wry-neck the head is drawn to one side and the chin is not elevated in the peculiar manner so characteristic of Pott's disease. In Pott's disease the pain is greater, the patient is apt to support his head with his hands, and the muscular rigidity is greater than in wry-neck. In Pott's disease the upper dorsal region is flattened.

A very important diagnostic point is that in wry-neck the head is rotated away from the contracted muscle, while in Pott's disease the head is rotated toward it (compare Figs. 17 and 24). It is important to make this differential diagnosis, because what might be the proper treatment for simple torticollis would be very dangerous in Pott's disease.

In cases of Pott's disease in which there is psoas contraction, it may be necessary to differentiate from hip-joint disease, because in both diseases there is a limp, limitation of motion, flexion, and adduction of the thigh. There should be no mistake made, however, because in hip-disease there is tenderness and restriction of motion in the hip-joint in every direction, while in Pott's disease the joint is not tender and motion is restricted only in extension, because but the one group of muscles affecting the movements of the hip-joint is involved. In cases of Pott's disease involving the dorsal and lumbar regions, the patient should be laid upon his back with the thighs flexed, and deep palpation made along the course of the psoas muscles (Fig. 38). The patient after a few times will become accustomed to this, and will so relax the abdominal muscles that a psoas abscess can be detected long before it reaches Poupart's ligament. It will be possible, in exceptional cases, to detect in this manner a swelling high up in the abdomen, and thus establish a diagnosis before deformity of the spine appears.

Prognosis.—Pott's disease is a chronic disease, the average length of time required for recovery being about three years, and notwithstanding the fact that this is one of the gravest of diseases, the natural tendency is toward recovery. About 25 per cent. of the cases end fatally sooner or later. A few die from exhaustion, but the vast majority die from complications. Young says that it may be safely said that more children perish from abscesses which open internally than from all other causes combined. This has not been the writer's experience, but abscesses always add to the gravity of the disease. Tubercular meningitis, phthisis, and amyloid changes are the common causes of death. Pulmonary complications are much more common in adults. Hemorrhage, due to injury to a blood-vessel by an abscess, is an occasional cause of death.

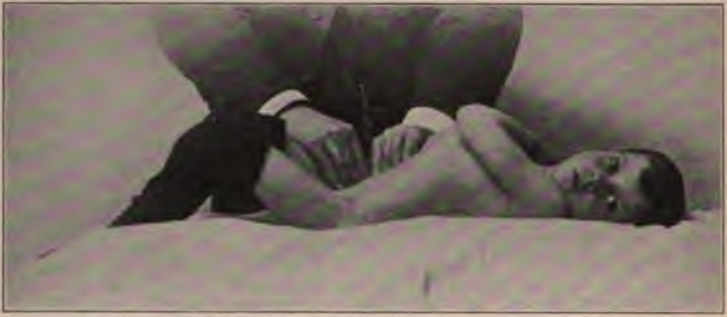

Fig. 38.—Examining for psoas abscess.

The prognosis is better in children than in adults, and is better in the lumbar and cervical regions than in the dorsal region. The deformity is permanent, and very likely to increase in spite of treatment, particularly in the dorsal region. Modern treatment, however, has made the prognosis better, both as to life and deformity.

Neidert states, as a result of his study of a series of cases at the Munich Pathological Institute, that persons with a slight deformity have as good a chance of life as normal individuals; persons with medium deformity die young, of phthisis; while persons with severe deformity die of heart failure or fatigue, before fifty.

The prognosis in paralysis of Pott's disease is good, the majority of cases recovering within a year, and nearly all within three years.

Paralysis of sensation and rigidity of muscles are bad symptoms, since they indicate disease of the cord, but recovery may take place when they have been present. Recovery from paralysis is complete. Relapses occur, but are also recovered from.

Every patient who recovers from a severe Pott's disease has a characteristic appearance that will mark him as long as he lives. His arms and legs seem unduly long, and the lower part of his face assumes a peculiar shape. His voice has a peculiar sharp tone, familiar to every orthopedist.

Treatment.—The great principle of treatment in this disease, as in tubercular ostitis elsewhere, is prolonged rest. Advantage is taken of the fact that the disease is confined to the bodies of the vertebræ, and, by means of proper mechanical appliances, the healthy transverse and spinous processes are made to carry the superincumbent weight. All varieties of apparatus take their fixed point about the pelvis, press forward upon the transverse processes opposite the center of the deformity, and pull the shoulders back. In other words, a brace acts as a lever, using the kyphos as a fulcrum.

When a diagnosis is made early, every effort should be made to prevent an increase of the deformity. Occasionally the existing deformity can be diminished, but this is not to be expected. When we are so fortunate as to have cases brought to us before deformity takes place, we may hope to prevent it, but, once established, we cannot promise to overcome it. At an early stage the general health is not much affected, as a rule, and medication is not called for. Later, particularly when abscesses exist, the general health may be seriously interfered with and may require medication. No medicine is known to have special effect upon the disease, but indications are to be met as they arise.

Pain may be a prominent symptom, for which the patient demands medicine. As a rule, opiates are to be avoided, for fear the patient may acquire the opium-habit. Fortunately, mechanical treatment affords such relief that medicine is seldom needed. When an exceptional case arises demanding an opiate, the writer has been best satisfied with codein for young children and hypodermic injections of morphin for older children and adults. Large quantities of an opiate, or a prescription that can be refilled for an indefinite number of times, are to be avoided as dangerous. The physician should keep the drug strictly under his control, for even with this precaution he assumes a great responsibility.

Disturbed digestion is a very common accompaniment of this disease, which requires medical treatment. The writer's practice in such cases is to give $\frac{1}{5}$ of a grain of calomel with sugar of milk every two hours until the bowels are thoroughly cleaned out, after which drop doses of tincture of nux vomica, with full doses of essence of pepsin, are given every three hours. Maltine, with pepsin and pancreatin, given with a little wine, yields excellent results.

When the child is not taking sufficient nourishment, "beef, iron, and wine," and plenty of good, rich milk should be given, taking great care that the bowels do not become constipated. Plenty of fresh air is very helpful in the treatment of this disease. When possible, the patient should be taken out of doors every day. At one time the writer believed that out-door exercise was absolutely necessary in the treatment of this disease, but after visiting institutions at home and abroad where the treatment is rest in bed, and noting the healthy, contented appearance of the patients, he has altered his opinion.

In certain cases where the deformity is increasing very rapidly in spite of the best mechanical treatment, rest in bed is the very best treatment, even in children (Fig. 39). In adults, especially when the disease is in the upper dorsal region, rest in bed is the best treatment. The writer has repeatedly seen such patients changed in a few weeks from pale, emaciated, suffering beings, apparently on the verge of the grave, to comfortable, well-nourished, healthy-looking persons, by perfect rest in bed. The best results are to be obtained by confining the patient to the bed all of the time. He should lie upon his back upon a solid hair mattress, with a very small pillow, or with no pillow. It seems like a serious undertaking to go to bed for a year or more, but when the patient is a young woman with the disease in the upper dorsal region, she can be assured that she will make the quickest recovery, and with the least deformity, in this way, and she is apt to choose this method of treatment. She should not even be allowed to lift her head, but must learn to eat and drink and attend to the calls of nature in this position. She can be assured that her general health will not suffer from the confinement. Bradford and Lovett,

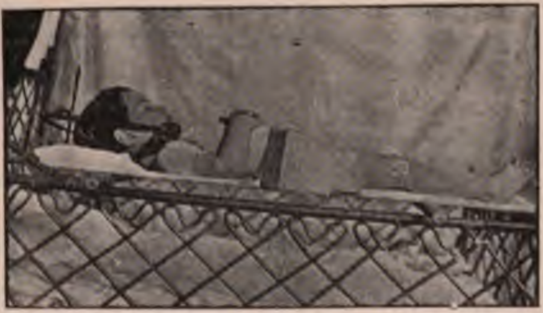

Fig. 39.—Recumbency in Pott's disease (Gillette).

however, believe that confinement to bed encourages the development of tubercular meningitis.

In children, the recumbent position can be carried out without depriving the child of fresh air by using an iron frame over which is stretched a piece of canvas (Fig. 40). The frame should be a little larger than the child, and a hole should be cut through the canvas so that a bed-pan can be used. The child is to be fastened to the frame, and can be picked up, frame and all, and taken out of doors.

Among the various materials used as mechanical support in the treatment of Pott's disease may be mentioned plaster-of-Paris, steel, felt, sole leather, aluminum, raw hide, and paper. A surgeon should not restrict himself to one variety of appliance, for the best results can certainly be obtained by a judicious selection for each individual case.

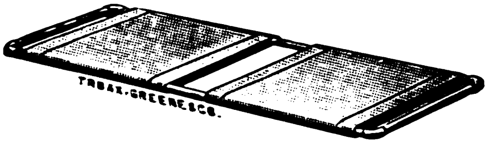
TRUAX, GREENE & CO.

Fig. 40.—The stretcher bed.

In the majority of cases in private practice some variety of steel support should be chosen. In charity work, and in certain select cases in private practice, plaster-of-Paris is almost indispensable. In the writer's opinion, no better support can be given in a case of lumbar Pott's disease than that given by a properly-applied plaster jacket. Suffering humanity owes a great debt of gratitude to Dr. Lewis A. Sayre for suggesting its use and teaching us how to apply it in this disease. Most of the objections raised against the plaster jacket are not valid, and are raised by persons who have not tried it, or who do not know how to apply it properly. The worst that can be said against it is that it cannot be removed as often as desirable to allow the patient to bathe. Every one, however, who is accustomed to its use, has seen fastidious ladies wear it, not only without murmur or complaint, but with great comfort and satisfaction. This objection can, of course, be overcome by opening the jacket and attaching hooks for lacing, but this destroys some of the best features of the jacket. It is a great advantage to have an appliance that is so fitted to the body that it cannot get out of place, and so constructed that it is entirely under control of the surgeon.

The plaster jacket is not nearly so good an appliance for disease in the upper dorsal and cervical regions as properly selected steel braces, but in charity work the writer has often been obliged to use it, and, with the addition of the jury-mast, has obtained good results.

A head support is demanded by every case above the seventh dorsal vertebra, no matter what kind of brace is used.

The patient should be prepared for the application of the jacket by applying a sleeveless knit undershirt, or, what is better, a stockinette made for this purpose. The prominent bony points should be protected by wool or soft felt, and in adult women and developing girls, pads should be applied over the breasts that can be removed after the jacket is hardened. A "dinner pad" is not necessary.

The most convenient plaster bandage for this purpose is one six inches wide and six yards long. Six of these bandages will be sufficient for a jacket for an average-sized adult, and for a child, from two to four, according to the size of the child, will be required. The mistake is often made of applying too many bandages and making the jacket too heavy.

The patient should be suspended by the head until the spine is made as straight as possible. He should be instructed to grasp the rope, with his hands well up, and pull (see Fig. 13). This keeps the arms out of the way, and is often all the extension that is necessary. It is a mistake to lift the patient off his feet, because it is uncomfortable and unnecessary, and frightens him so that he dreads a re-application. Properly conducted, this need not be a painful or alarming process. When the patient is a child, it will add very materially to the surgeon's comfort to stand him upon a stool. The bandages should be placed on end, in plenty of warm water, until bubbles cease to rise, when they should be gently squeezed in the hand to get rid of the surplus water, and applied from below upward. Just as one bandage is taken out of the water, another should be put in. The jacket should extend from just above the trochanters, well up to the neck (Fig. 41). The bandages

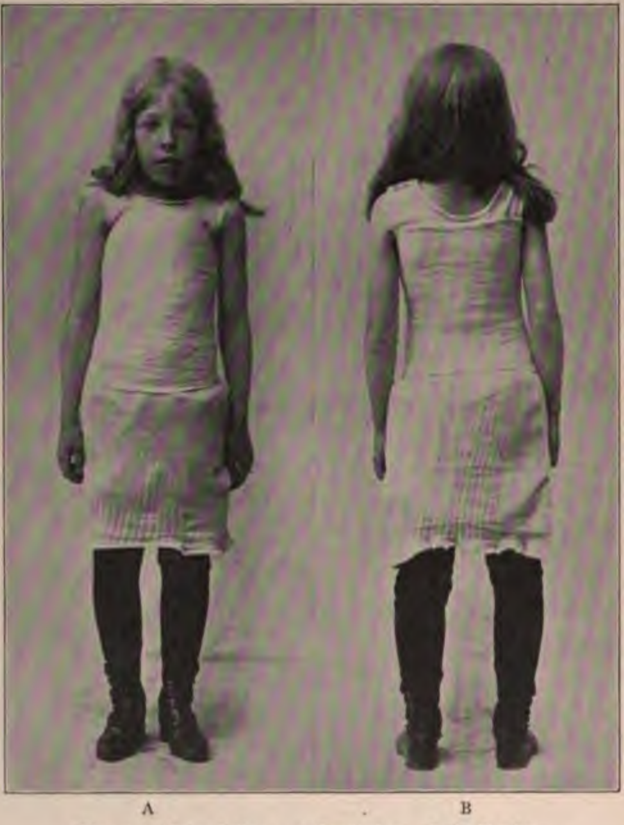
A B

Fig. 41.—Plaster jacket. A. Front view. B. Back view.

should be applied comfortably tight, and should overlap one another in such a manner as to make the jacket of an even thickness throughout. At the last, it is well to apply a couple of extra turns of the bandage at the upper and lower edges and at the waist-line, as these are the points where the greatest strength is required. Every layer should be rubbed well as it is applied, so as to make it adhere to the one underneath, and the whole jacket should be well

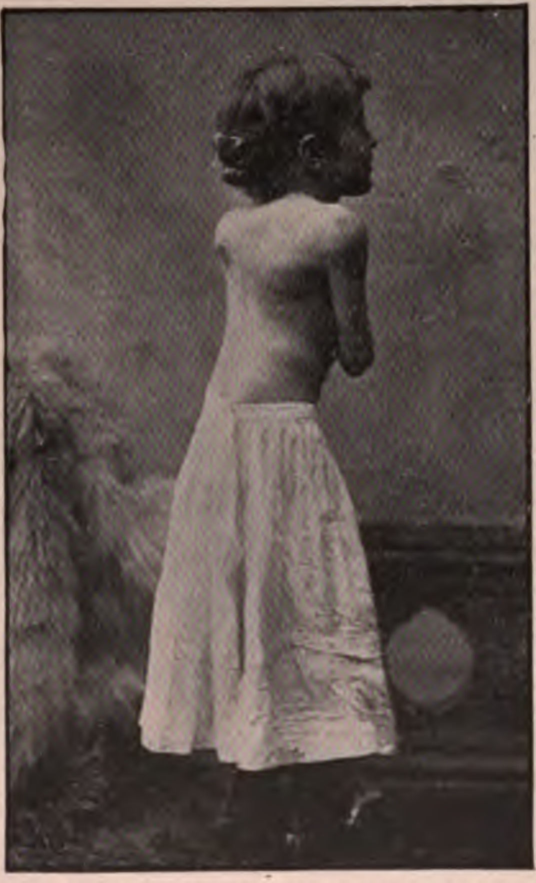

Fig. 42.—Showing an unsuitable case for a jacket (Gillette).

molded to the shape of the body as it hardens. When good bandages are used, the jacket hardens in a very few minutes. While it is hardening, the edges should be smoothed by the fingers, and it should be cut under the arms so as to be comfortable. The jacket should not be expected to bear weight under the arms, but by grasping the body as a whole it should so support the body that the minimum amount of weight will fall upon the diseased bodies of the vertebræ.

When the patient lives at a distance from the attendant, a jacket may be worn three or four months, but it is desirable to change it once in a month or six weeks.

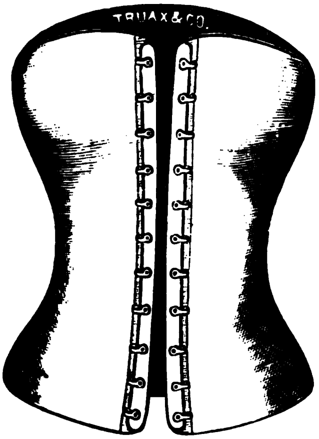

Fig. 43.—Laced plaster jacket.

When it is desired to make the jacket to lace, it is to be applied in the usual manner, and cut down the median line in front before it is too hard. It can then be removed, and should be held in shape by a roller bandage until it is thoroughly dried. A row of eyelets or hooks attached to a strip of leather is then fastened to either edge, by which it can be laced up like a corset. This makes a very convenient convalescent brace (Fig. 43).

Various other methods of applying a jacket have been suggested, but none can compare favorably with the above, as originally taught by Dr. Sayre. Figure 44 illustrates one of these methods.

When head support is required, it is secured by the attachment to the jacket of a "jury-mast," which consists of a strip of steel extending from the jacket up along the back of the neck and head, and curving over the top of the head in such a manner that a sling can be attached to it in which the head and chin rest (Fig. 45). The upright must be so placed that it will not make pressure upon the neck or head. The sling is attached to a cross-piece attached to the upper extremity of the upright. The principle is, that the weight of the head will be conducted, by this appliance, to the hips of the patient, thus relieving the diseased vertebræ (see Fig. 31). A jury-mast should be made in two parts, connected by screws, so that the head-piece can be removed when necessary without removing the whole apparatus. When attaching it to a plaster jacket the greater part of the jacket should be applied first, so that just enough plaster is applied over the iron to hold it in place. If it is applied too closely to the body it may create ridges on the inner side of the cast that would cause great discomfort to the patient.

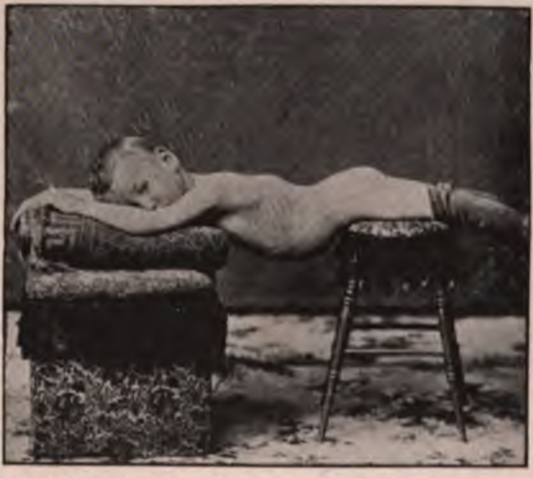

Fig. 44.—Method of applying plaster jacket when for any reason suspension cannot be employed (Gillette).

The plaster jacket is not the best method of treating disease of the upper dorsal or cervical regions, but with care and skill good results can be obtained. Where the patient is able to bear the expense of a better appliance, this one is not to be recommended for disease in these regions.

In extremely sensitive cases, relief, and even permanent cure, may be effected by extending the plaster cast up over the head in such a manner as to carry the weight of the head and prevent motion at the diseased point.

No fixed rule can be laid down for the selection of the variety of brace to be used in a given case. In all charity work, plaster-of-Paris readily takes the lead, because of its cheapness, and because it can always be at hand ready for immediate application.

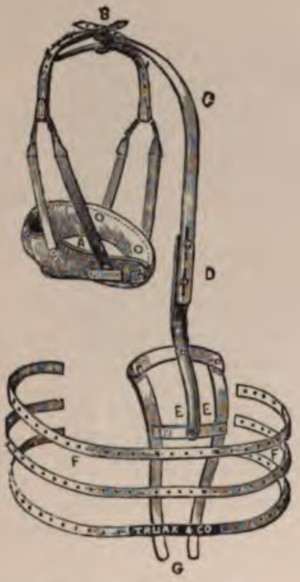

Fig. 45.—Sayre's jury-mast.

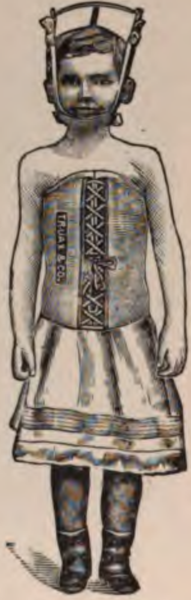

Fig. 46.—Jury-mast attached to leather jacket.

In the majority of cases in private practice, and in all cases of upper dorsal and cervical disease, some form of steel brace is preferable. The steel brace is neater, cleaner, and meets with fewer complaints from the patients than the jacket does. It can be examined and refitted frequently and with little trouble. In skilled hands it can be made to meet every indication.

Bradford and Lovett have called attention to the fact that the steel brace is not so well adapted to cases with lateral deviation as the plaster jacket.

The steel brace, or anteroposterior support, acts upon the principle of a lever, the weight being at the hip-band, the fulcrum at the seat of deformity, and the power at the shoulders. The variety known as the modified Taylor brace embraces all of the best features of this variety of appliance (Fig. 47). It consists of a steel band which partly surrounds the pelvis at a point between the trochanters and the crest of the ilium ; of two uprights of annealed steel extending from the waist-band along the transverse processes of the vertebræ to the shoulders, and of a horizontal bar opposite the points of the shoulder-blades. The pelvic band is completed by soft leather, and to the upper end of the uprights are attached strips of webbing which surround the shoulders and are buckled to the ends of the horizontal bar. Opposite the deformity, the uprights are hinged, and well padded. The uprights are placed wide enough apart to prevent pressure upon the spinous processes, bearing entirely upon the transverse processes. The brace is held close to the body by a cloth apron, extending from the clavicles to the symphysis pubis, to which are attached strips of non-elastic webbing (Fig. 48). These strips are buckled snugly over the outside of the brace. It will sometimes be necessary to pass strips of webbing over the shoulders, to prevent the apron from slipping down.

A brace cannot be bought ready made, but must be made from careful measurements for each individual case, because its usefulness depends upon the proper fit. A brace that does not fit properly will not only fail to do good, but will chafe the skin and add to the suffering of the patient, thus leading to failure and disappointment, and bringing treatment into disrepute. Dr. Judson has established the following rule:

"The apparatus may be considered as having reached the limit of its efficacy if it makes the greatest possible pressure upon the projection compatible with comfort and the integrity of the skin." The uprights must not be too light or too highly tempered, so as to allow them to give too much, and thus allow a bending forward of the spine.

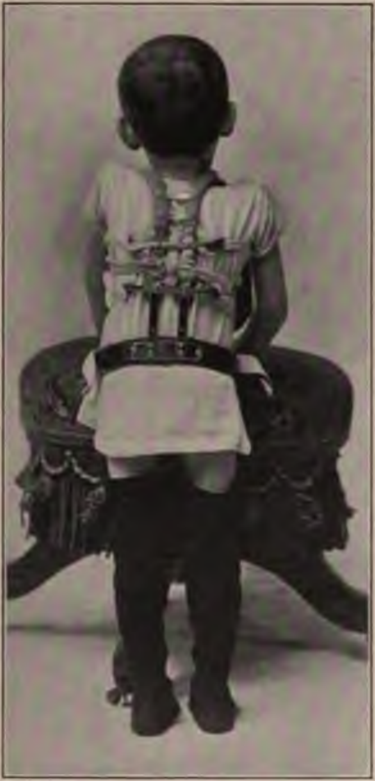

Fig. 47.—Modified Taylor's brace.

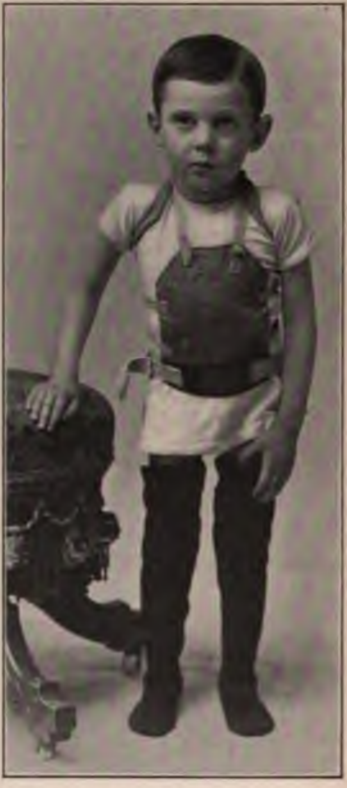

Fig. 48.—Showing apron of spine-brace.

When taking measurements for the brace the child should be laid upon its face, with the body uncovered, and an outline of the spine taken by a strip of lead or block tin (Fig. 49). This should be laid upon a piece of stiff paper and the outline traced by a pencil. The paper can then be cut so that its edge will be a perfect outline of the spine and can be used by the instrument-maker as a pattern. A tracing should also be taken from the lead upon a page of the surgeon's case book, so that, by comparing future tracings, he may know whether the deformity is increasing or not.

To apply the brace, the child should be laid upon its face with the apron spread under it. In this attitude the spine is in the best possible position, and the brace can be accurately fitted. The brace is then applied so that, when the pelvic band is buckled and the pads fitted to the deformity, the upper ends of the uprights will stand out just a little from the back. Then, when the straps around the shoulders are buckled, extra pressure will be made over the kyphos.

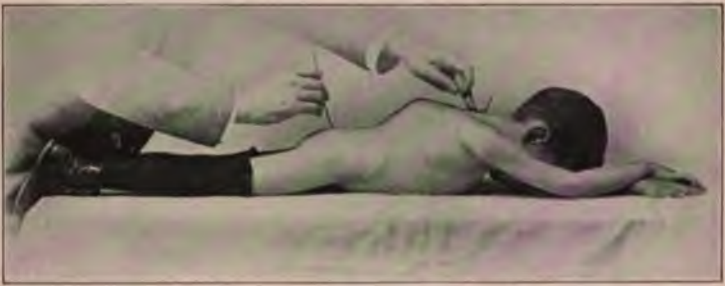

Fig. 49.—Taking outline of spine with strip of lead.

The child should never be allowed to stand a moment without his brace, and when the brace is removed, as it should be daily for a bath, he must be handled with the utmost care. The brace should not be removed until many months after all active symptoms have disappeared. The hinge in the Taylor brace adds very materially to its cost, and is more of a convenience than a necessity, so it may be dispensed with.

The Washburn brace has no hinges, but is otherwise practically the same as the Taylor brace. Its shape can be changed at any time by bending the uprights. This is a very satisfactory appliance (Fig. 50).

It is necessary to mention one more variety of brace in order to condemn it. It has some of the features of the Taylor brace, but depends for its usefulness upon crutches making pressure in the axilla. Unfortunately, this is the variety of brace most frequently sold by instrument-makers to physicians not skilled in orthopedics and to persons who try to dispense with a medical adviser. It is inefficient, because light pressure under the movable shoulders does not afford support and heavy pressure cannot be endured.

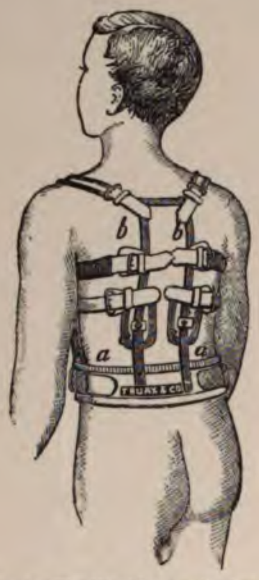

Fig. 50.—The Washburn spine-brace.

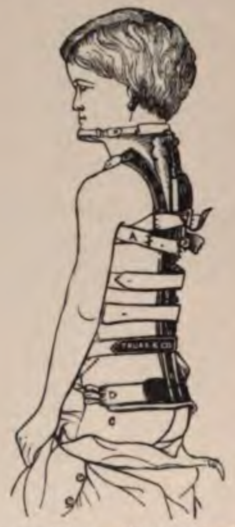

Fig. 51.—The modified Taylor brace, with head-piece.

When the disease is above the seventh dorsal vertebra, head support is indicated, and it is a difficult problem for one unaccustomed to orthopedic work. The jury-mast can be attached to the steel brace just as readily as to the plaster jacket, but is inconvenient and unsightly. Dr. Taylor's head-piece is the most commonly used. It consists of a light steel band shaped to the under side of the head and chin, and fastened to the brace by a steel upright at the back (Fig. 51). This, properly padded, is very comfortable and efficient. A very ingenious device has been invented by Dr. Shaffer which enables one to adjust the head-piece at any angle desired. The only objection to it is its expense.

Lateral deviation sometimes interferes with the fit of the steel brace at first, but it usually disappears in a short time.

Numerous devices have been invented for the treatment of cervical disease which do not require the spinal brace. A collar fitted over the shoulders and under the head meets the indications very well and can be made from plaster-of-Paris, leather, felt, or wire (see Fig. 25). A case of cervical Pott's disease, accompanied by severe pain, may be temporarily treated by rest in bed and traction upon the head by means of a weight and pulley.

The treatment of abscesses is a topic concerning which the most extreme views are held, the over-conservative urging that they should be allowed to run their course unmolested, and the heroic surgeons advocating operative procedures in every instance. The best treatment undoubtedly lies between these two extremes. The term "conservatism" has been sadly abused by a certain class of do-nothing surgeons. It is not conservatism to refuse to operate on every case simply because some cases are better without operation. On the other hand, there is little doubt but that if it were the rule to operate upon every case of abscess as soon as diagnosed, the mortality rate would be increased.

It is impossible to lay down exact rules as to when to and when not to operate, because each case must be a law unto itself. The surgical axiom, that whenever pus is found it must be evacuated, is not applicable to the so-called abscesses of Pott's disease, because they do not contain true pus. It is an established fact that in a certain percentage of these cases the abscess will be absorbed, and that a goodly number will recover if allowed to evacuate themselves without interference ; but this is no argument against operation when it is indicated, as it undoubtedly is in some cases.

It is the opinion of those who have had most experience in the operative treatment of these cases, that when an abscess is rapidly or persistently increasing in size, or when the health of the patient is failing, or when serious pressure symptoms are present, operative interference is indicated.

Repeated aspiration has yielded some good results, but is often a waste of valuable time, and is not to be recommended. The needle is apt to become clogged, and, at best, removes only the least harmful part of the contents.

Evacuation through a small incision or a larger trocar, followed by thorough irrigation with disinfecting lotions and subsequent injections of an emulsion of iodoform, followed by immediate hermetic closing of the wound, is to be highly recommended. In the writer's hands, this treatment has yielded very gratifying results. The washing out should be thorough, first with a 1 : 2000 bichlorid solution, and afterward with sterilized water. From two drams to two ounces of a ten per cent. emulsion of iodoform should then be injected, and the wound be hermetically sealed. The amount injected is regulated by the age of the patient. This operation will usually have to be repeated once or twice at intervals of from one to three weeks.

When injection fails, or when, for any reason, incision is preferred, it should be free and thorough. In a psoas abscess, for example, at least two openings should be made, one at the lowest point and one in the loin, and after thorough evacuation of the contents and irrigation with a bichlorid solution, drainage-tubes are introduced and a surgical dressing applied. It is futile to use the curet in these cases, because the whole abscess cavity cannot be reached, and a partial curetting only increases the danger of general tubercular infection. The dressings must be reapplied as often as soiled, and the tubes allowed to remain as long as there is sufficient discharge to require their presence.

The danger is that pyogenic germs may gain entrance to the abscess cavity and produce a mixed infection. This eventually occurs in all cases, but, after sufficient time has elapsed to establish healthy granulation, it is not a serious matter.

The fact that these wounds become infected is no argument in favor of allowing them to open themselves, because the same thing always happens when they are let alone.

In lumbar and psoas abscesses it is not sufficient to open the most prominent point, because there are always two parts to them, one internal and one external to the fascia, communicating by a small opening through the fascia. Either this opening in the fascia must be reached and enlarged, or both parts of the abscess must be reached directly.

A retropharyngeal abscess occurring with cervical disease is a grave complication, since, in addition to the ordinary dangers of an abscess, there is the danger of suffocation from rupture into the throat. It should be promptly opened, with the head hanging backward over the end of a table. This position allows the discharge to take place through the nostrils, and avoids the danger of suffocation. This position also affords ready access to the abscess, and, with the aid of a gag, enables one to see just what he is doing.

A better way, in some cases, is to make a free incision along the posterior border of the sternocleidomastoid muscle, push the large blood-vessels forward, and reach the abscess directly without communicating with the mouth. This is a more formidable procedure than the other, but the wound is less liable to become infected before healthy granulations are established.

Psoas contraction sometimes becomes so marked and persistent a symptom as to require treatment. We have, in the Northwestern Hospital, one patient facetiously spoken of as the "quadruped," because his double psoas contraction compels him to get about on all fours (see Fig. 29). Before the deformity is too old and well established, it can best be overcome by weight and pulley. This treatment will need to be kept up enough of the time to prevent relapse. Later, when the deformity remains after the disease is well, the only way to overcome it is to perform an osteotomy just below the trochanters, placing the limb in the straight position, and treat as a simple fracture of the femur. This treatment is very satisfactory, and should always be recommended in severe cases.

Paraplegia requires no special treatment, aside from the care of the bladder, bowels, and integument, as in paraplegia from other causes. Very large doses of iodid of potassium, from 100 to 300 grains three times a day, have been highly recommended by Gibney, but it disturbs the patient's digestion and makes him feel badly, and he will get well just as surely and almost as quickly without it.

Laminectomy, or removal of a part of the arches of the vertebræ, has been suggested in paralytic cases, and has been practised enough to teach us that the mortality rate is very large, and that the results are not correspondingly good. It certainly is not to be considered until the paralysis has extended beyond the time when recovery usually occurs.

TYPHOID SPINE.

Gibney has reported a number of cases* in which the patients suffered from what he terms "typhoid spine." The condition comes as a sequel to typhoid fever, and is characterized by constant pain, which is aggravated by lateral or forward motion, tenderness upon pressure, especially in the lumbar region, and rise of temperature. Some of these cases come on following a contusion, and others without apparent cause. He believes the condition to be a periostitis, and that the term "perispondylitis" might be appropriately applied if it were understood that the term did not signify tuberculosis. The patients recover in a few weeks, either with rest in bed or spinal support.

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* See "Trans. American Orthopedic Association," vols. ii and iv.

CHAPTER VI.

INFANTILE SPINAL PARALYSIS; PROGRESSIVE MUSCULAR ATROPHY.

This is an acute paralysis of children, and is due to an acute inflammation of the anterior cornua of the spinal cord (Fig. 52). It has been known by a variety of names, such as poliomyelitis, essential paralysis of children, acute atrophic spinal paralysis, and myelitis of the anterior horns.

Etiology.—The exact cause of this inflammation is not well understood. The vast majority of cases occur in children under three years of age, during dentition. This is so common that it has been called "teething palsy." It occurs during extremes of hot or cold weather, especially when bowel troubles are prevailing. Traumatism, sitting on the cold ground, and overexertion have been mentioned as causes, but it is difficult to prove that they bear any such relation, because the disease frequently appears in apparently healthy children when no cause can be assigned. Boys and girls are affected alike. It occurs as a complication or a sequel of measles, scarlet fever, typhoid fever, and pneumonia.

Pathology.—Microscopic appearances show that this is undoubtedly an acute non-suppurative inflammation of the anterior horns of the spinal cord. It is most severe at the cervical and lumbar enlargements, but is more or less diffused along the cord. It may be unilateral or bilateral.

The inflammation is destructive in character, some of the large multipolar ganglion-cells always being destroyed.

In recent cases the microscopic changes are slight, but in old cases the cord is shrunken. The microscope shows changes at an early date. Polar cells may be seen in all stages of atrophy. The destroyed tissues are replaced by connective tissue. The cornua may be completely destroyed and replaced by connective tissue.

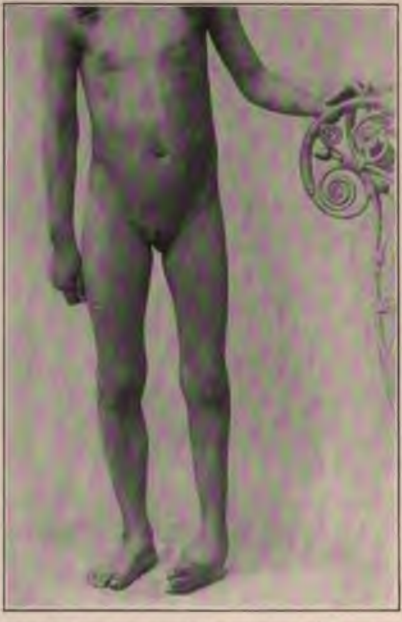

Fig. 52.—Infantile spinal paralysis affecting left lower extremity.

The muscles lose their striæ, and undergo rapid granular degeneration, until nothing is left but fat and muscle corpuscles contained in the sarcolemma. The inflammation does not extend to the brain.

The bones become atrophied. A long bone may show several inches shortening, partly owing to atrophy and partly to interference with growth. Dislocations and distortions of joints are late effects of this disease.

Symptoms.—This disease may be divided into three stages, which gradually run into one another; the stage of onset, of convalescence, and of deformity.

Paralysis is the first characteristic symptom. A number of symptoms are mentioned as belonging to the pre-paralytic stage, such as diarrhea, convulsions, and pain in the back; but it is more rational to speak of these as the results of a common cause, since they often exist without paralysis. In a large percentage of cases of poliomyelitis the child will have convulsions and diarrhea, but, on the other hand, many cases occur in children in seemingly perfect health. The paralysis comes on very suddenly, generally during the night, and reaches the maximum in a very few hours. It is not uncommon to find a child paralyzed in the morning who had retired in apparently perfect health. Exceptionally, the whole body may be affected, when the disease is apt to prove rapidly fatal. As a rule, however, only portions of the body are affected, and the tendency is toward improvement. Both lower extremities, or one lower and one upper extremity, may be affected. In the majority of cases the paralysis is confined to one lower extremity. Occasionally the bladder is affected for a short time at first; but it always recovers in a few days. When an arm and a leg are affected, the arm begins to improve first.

The paralysis remains stationary for a short time only, when it is followed by the stage of convalescence. In from two to six weeks decided improvement will be noticed. For the first few weeks improvement will be quite rapid, after which there is a period of slower improvement. After six months little, if any, improvement is to be expected. Recovery is never complete, certain groups of muscles remaining permanently paralyzed. In the lower extremities the extensors, the peroneal group, and the quadriceps extensor are the muscles most frequently permanently affected. In the upper extremity the deltoid suffers most frequently. The diaphragm, abdominal, and back muscles may be affected.

The paralysis affects motion only, sensation being unaffected. In a few cases the muscles are hypersensitive for a time.

Atrophy is an early and characteristic symptom. It begins in a few weeks and progresses rapidly. The circulation is poor. The limbs become cold and blue; pressure upon them will leave a white spot, to which the color slowly returns. Painful, unhealthy ulcers may form. The reflexes are entirely abolished.

After a few months, owing to paralysis and trophic changes, deformities appear. In the foot, talipes equinovarus, calcaneovalgus, equinus, calcaneus, and cavus occur, their frequency being in the order mentioned.

Flexion of the knee, with subluxation backward of the tibia, may occur. Hyperextension and knock-knee also occur. These deformities are the result largely of unopposed muscular contraction. The leg may be loose or flail-like. The hip may become flexed, causing lordosis of the spine. When the anterior and internal muscles of the thigh are affected, the whole limb becomes rotated outward, and is very weak and useless. The upper extremities are rarely deformed from this disease. The sternocleidomastoid may be affected, causing wry-neck. The spine may become deformed on account of paralysis of the erector spinæ muscles, or on account of the shortening of one leg (see Fig. 5).

The deformity may be a scoliosis or a kyphosis, owing to the muscles affected. Dislocation of the hip upon the dorsum of the ilium has occurred in old severe cases, causing one or two inches shortening.

Diagnosis.—The diagnosis, except in very mild cases, is not difficult. It is never made before the appearance of the paralysis. The sudden, painless onset reaching its maximum in a few hours, affecting motion only, accompanied by loss of reflexes, and speedily followed by atrophy and partial improvement, make a history that can hardly be mistaken. Later, the peculiar deformities and blue, cold extremities are quite characteristic. Specialists who have skill in the use of electricity have a certain means of diagnosis in this disease, owing to the peculiar electrical reaction—the so-called reaction of degeneration. This means of diagnosis, however, is not available for the average practitioner, since he does not possess the requisite amount of skill to apply it. This, like many other affections coming under the care of an orthopedist, is often called rheumatism, but bears no resemblance whatever to it.

At an early stage it may be difficult, or even impossible, to differentiate between this affection and cerebrospinal meningitis, but after a little time there need be no difficulty. In the latter the patient is very ill, and has higher temperature, retraction of the head, and brain symptoms that do not belong to the former. Many cases of paralysis in children, said to have been caused by cerebrospinal meningitis, are undoubtedly cases of poliomyelitis, because the former disease is not followed by permanent paralysis.

The so-called rachitic paralysis need give very little trouble in the way of diagnosis, because, upon examination, it will be found not to be a true paralysis, and other symptoms of rickets will be present.

Diphtheric paralysis affects muscles of the palate, and is not followed by atrophy. Poliomyelitis may occur as a complication or sequel of diphtheria.

Congenital dislocation of the hip has been mistaken for this disease, but it need only be thought of to be diagnosed, for it is not accompanied by paralysis or marked atrophy.

In hip-joint disease, instead of paralysis, there is muscular contraction and limitation of motion. The atrophy is not nearly so well marked, and the limb does not become blue and cold. In hip-joint disease there is a long history of pain and inflammation, while in poliomyelitis the symptoms of inflammation are either absent or very mild.

The paralysis of Pott's disease is accompanied by the pain, deformity, and other symptoms of Pott's disease. The reflexes are exaggerated, the paralysis is usually bilateral, and atrophy is not marked.

Cerebral paralysis may begin suddenly and with convulsions, but the paralysis is hemiplegic and there is accompanying facial paralysis. The reflexes are exaggerated; the electrical reaction is normal, and the atrophy is not marked or rapid. The deformities following cerebral paralysis are spastic in character.

Spinal paralysis, due to hemorrhage in the cord, is bilateral, and is complete both as to motion and sensation. Bladder troubles and bed-sores soon follow.

Acute transverse myelitis is rare in childhood. It affects both legs, and usually sensation, as well as motion. The electrical reaction is normal, and the reflexes are exaggerated. Bed-sores and bladder troubles begin early.

Prognosis.—It is seldom that this disease ends fatally, and when it does, it is usually due to paralysis of the respiratory muscles. The paralysis rarely grows any worse after the second day, and usually shows improvement within two weeks. It is always safe to say to the parents that the paralysis is as bad the first day as it is likely to be, and that there is sure to be some improvement. It is never possible, however, to say at first how great the improvement will be. Duchenne lays down the rule that muscles that respond to the faradic current during the second week will recover. Second attacks are very rare. The improvement usually begins in the second week, and progresses rapidly for a couple of months, after which there is a period of slower improvement of about four months. After six months, little, if any, improvement is to be expected. The improvement is confined to certain groups of muscles, and, owing to the loss of balance between muscles, there is sure to be deformity unless prevented by proper treatment. Although the paralysis grows no worse as the child grows older, the deformity increases unless prevented by mechanical means. In some cases there is marked atrophy of bone, causing shortening of the limb.

From a strictly orthopedic standpoint, the prognosis is far better than is generally believed. It is only when deformity is well established that the orthopedic surgeon sees these cases, but even then he can overcome the deformity, restore muscles that were apparently paralyzed, and many times put the patient upon his feet. Any effort at this time to restore completely paralyzed muscles is futile. Partly paralyzed muscles can be strengthened and developed, providing they are placed in the normal position and given proper mechanical support. Any kind of treatment without mechanical support will fail.

Treatment.—The treatment is medical, mechanical, and operative. There cannot be said to be any treatment before the appearance of the paralysis, because the disease is not recognized. As soon as recognized, however, it is very natural to give medicine, but with how much benefit it is very difficult to say. Many remedies have been highly spoken of because rapid improvement followed their administration, but the improvement would have taken place just the same had they not been administered.

Indications must be met, the bowels and diet regulated, and deformity prevented. It is rational to give ergot and the bromids, and to apply cups along the spine soon after the attack. The child's position should be either upon the side or face, so as not to encourage stasis in the part affected. The limbs should be moved and the joints exercised from the very first. Gentle rubbing should be practised often. Later, when the inflammation has subsided, strychnin should be given, and massage and electricity should be employed. The galvanic current should also be used.

Electricity has enjoyed a great reputation in these cases, but the amount of good it does is questionable. It must be borne in mind that the disease is not in the muscles, but in the spinal cord. In old cases, such as come to the orthopedist, after deformity is well established, electricity can often be used to good advantage after the deformity has been overcome and the proper apparatus applied. It is useless, unless the orthopedic treatment is first carried out, because it is not the muscles that are completely paralyzed on account of the destruction of the nerve-cells supplying them that are to be benefited, but it is the muscles that have some nerve supply left that can be strengthened and developed. These weakened muscles cannot be improved by electricity or anything else until they are placed in their normal position and are given some assistance by mechanical means.

As compared with paralysis from other causes, there is very little tendency to the formation of bed-sores in this disease, but great care should be exercised to keep the child clean and to change its position often enough to remove all danger of this complication. Pain will not be severe enough in any case to require special attention. Opiates are contra-indicated.

A duty very commonly neglected by the family practitioner is to prevent deformity as much as may be. Beginning at an early period, it requires very slight mechanical support to keep the limbs in the normal position. While the child is confined to bed, the necessary support can be given by means of pillows and sand-bags, but as soon as he is able to sit up a suitable apparatus should be applied. Sole-leather, felt, and plaster-of-Paris may be applied until steel braces can be made, but should be looked upon as only temporary arrangements, since they would have a tendency to interfere with the proper nourishment of the limb. The special variety of apparatus to be applied in each case at an early period should be just the same as that which will be advised for a case after deformity has been overcome.

These cases are brought to the orthopedist after deformity has taken place, and his duty is, if possible, to overcome the deformities, and so support the weakened extremities by mechanical means as to enable the patient to walk. The deformity can often be overcome by mechanical means, but sometimes operative measures are necessary. Since certain muscles are permanently destroyed, it will be necessary to permanently supply this deficiency by mechanical means, unless, as is happily often the case, by operative measures the crippled extremity can be made to perform its function without artificial help.

Before applying permanent apparatus it will be necessary to first overcome the deformity. This can often be accomplished in a comparatively short time by continuous pressure, applied in the proper direction, and when it can be so done, it is preferable to operation. When it is found, however, that the method will require too much time or cause too much suffering, tenotomies of fasciæ and tendons, followed by forcible correction, are better.

In cases of equinovarus, the tibialis anticus, the tendo Achillis, and the plantar fascia may require tenotomy. In calcaneovalgus, the peroneal group may have to be cut. In equinus, the tendo Achillis alone will require tenotomy, and in calcaneus this tendon will have to be shortened. The process suggested by Willet for shortening the tendon consists of cutting the tendon obliquely, overlapping the cut ends, and sewing them together with catgut. The tenotomies required for these deformities are performed just the same as for contracted tendons elsewhere, simply avoiding nerves and blood-vessels. After a tenotomy for a club-foot due to paralysis, it is not necessary or advisable to overcorrect the deformity before applying retention apparatus, as should be done in congenital club-foot, but the foot should be placed in the normal position at once. Older writers feared to tenotomize tendons for paralytic club-foot for fear of causing a flail-foot, but their fears were groundless.

In the operation for shortening the tendo Achillis, an incision two inches long should be made parallel with the tendon, and the tendon exposed. It should then be cut more or less obliquely through ; the ends are then lapped over each other until the foot is brought to a right angle to the leg, and stitched together, the stitches being so placed as to take firm hold, and so that they will not constrict the tissues too much. Gibney recommends a Y-shaped incision as affording better access to the tendon.

Before undertaking this operation, a thorough examination of the calf-muscles should be made to ascertain whether they are entirely paralyzed or not, for if they are, the operation would be entirely useless. Robert Jones advises that when the tendon is shortened, arthrodesis should be performed upon the ankle-joint to prevent relapse.

After tenotomy, the limb must be placed in a plaster-of-Paris cast, or other fixed dressing, for at least two weeks, and four weeks are better. There is a constant tendency to stretching and relapse, and this must be guarded against by mechanical means, or by following Jones' advice.

A very efficient means of preventing relapse after shortening the tendo Achillis is to apply a leg-brace, consisting of two uprights extending from the bottom of the shoe up either side to a band just below the knee. The half of this band going back of the leg should be of steel, and should be firmly riveted to the upper end of the uprights. It should be padded and covered with leather, and the anterior half should be made entirely of leather, with buckles for fastening around the leg. To the middle of the steel band should be attached a wire loop, to which is attached an artificial muscle, made of stout rubber webbing or tubing, and extending down to the heel of the shoe, where it is firmly attached. The uprights should be jointed opposite the ankle. A spring may be substituted for the rubber tubing.

For other deformities of the foot, this same brace, without the artificial muscle, and with the addition of a steel sole to the shoe, can be used. This sole should be very light, but should cover the whole bottom of the shoe in front of the heel, in order to prevent the twisting of the shoe that surely occurs unless this precaution is taken.

In all cases in which a part of the deformity is an equinus, a lock should be put in the joints, so that the toes cannot drop further than to a right angle with the leg. Rubber muscles can at times be attached to take the place of weakened or paralyzed muscles.

It will frequently be found, after correcting a deformed foot and giving a proper mechanical support, that some of the muscles that were supposed to be quite useless will develop considerable strength. If a healthy muscle were to be constantly overstretched, it would soon undergo atrophy and become weakened and comparatively useless. After straightening a foot of this kind, massage and electricity should be persistently applied, not to attempt to restore completely paralyzed muscles, for that would be useless, but to restore and strengthen muscles that have only been weakened.

An operative procedure that is of comparatively recent date is to substitute a healthy muscle for a paralyzed one. This is accomplished by cutting the tendon of the healthy muscle and attaching it to that of the paralyzed one. A number of very gratifying results have been reported by various writers.

Nicoladoni recommends that, in a case where the gastrocnemius and soleus are completely paralyzed, and the peronei are healthy, the latter be made to do duty for the former.

The operation is performed as follows : An incision is made over the peronei tendons, extending from the malleolus far enough up the leg to freely expose the tendons. A transverse incision is now made near the lower end of the first one, the flap is dissected up, exposing the peroneal tendons and the tendo Achillis. A sufficient space is now denuded on the side of the tendo Achillis, the peroneus longus and brevis tendons are cut across, opposite the malleolus, and their ends fastened to the denuded surface of the large tendons ; or, what is better, the tendo Achillis is split longitudinally and the ends of the peroneal tendons passed through the opening and sewed there with catgut.

Dr. Goldswaith, of Boston, read a paper before the American Orthopedic Association, September, 1895,* in which he reports several cases of tendon-grafting with satisfactory results.

Milliken reports, in the *Medical Record* of October 26, 1895, a case in which a part of the tendon of the extensor pollicis was grafted into the tendon of the tibialis anticus with very successful results.

It would seem, from the few cases reported, that tendon-grafting is destined to have a brilliant future.

In some cases of infantile paralysis the muscles controlling the movements of the ankle-joint are so completely paralyzed that the joint is flail-like and useless. In such cases an effort should be made to make the member support the weight of the body by stiffening the ankle-joint. This operation is known as arthrodesis, and has afforded some very gratifying results. The ankylosis is usually ligamentous in character, and the loss of motion in the joint is in a measure compensated for by an increase in the amount of motion in the mediotarsal joint.

The operation consists in opening the joint and removing the cartilages from the joint surfaces. Various points have been suggested for entering the joint, but the writer has been best pleased with an incision along the outer margin of the tendo Achillis, entering the joint from behind. The muscles offer no resistance, so that it is comparatively easy to open the joint sufficiently to admit an instrument. A knife, gouge, or Volkmann spoon may be used for removing the cartilage. It is not necessary to get all the cartilage away. After removing the cartilage, the wound is closed with catgut and a surgical dressing applied, and over this a plaster cast, which should remain for at least a month. Since the union is only ligamentous, mechanical support may be necessary. This is a safe, and, many times, a satisfactory operation, but should never be undertaken by one who is not thoroughly familiar with modern surgical methods.

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* See vol. viii of "Transactions."

At the knee the deformity is usually a flexion. Subluxation backward of the tibia is very common. Occasionally knock-knee will be present. In the majority of instances the flexion can be easily overcome by mechanical means, without operation. Extension by weight and pulley will often answer very well, but it keeps the patient in bed. When there is no tendency to displacement backward of the tibia, a very simple and efficient way to straighten the knee is to apply a straight posterior splint, well padded at the ends where it has its bearing, and gradually draw the knee down by means of an elastic bandage until the popliteal space touches the splint. The bandage must be applied lightly or it will cause great discomfort where the ends of the splint touch the calf and back of the thigh. Carefully applied, this will yield prompt and satisfactory results. The ordinary Martin bandage is rather better than an Esmarch bandage, because it is lighter and not so likely to make too strong a pressure. It should be wound around the limb and splint as if the splint were being applied for a fracture. When there is any tendency to backward displacement, this method cannot be used. In this case some form of splint or brace must be used that will push the tibia forward ; or, if extension by weight and pulley be resorted to, extension must be made in two directions—viz., in the direction of the long axis of the tibia, and forward on the upper end of the tibia in the direction of the long axis of the thigh. In some cases brought to the orthopedist, the deformity is so fixed that too much time would be required to overcome it by mechanical means, and operative measures should be resorted to at once. The hamstring tendons, and sometimes the popliteal fascia, will require cutting. When the fascia is involved, it is better to make an open transverse incision, through which both the fascia and the tendons can be cut. This should be done under aseptic precautions, and immediately closed up. When the fascia is not involved, the tendons should be tenotomized subcutaneously. The tenotome should be introduced on the side next the popliteal space for both tendons, taking special care, when cutting the outer tendon, to keep very close to it to avoid cutting the external popliteal nerve, which lies close by. After tenotomy, the deformity should be at once overcome, and the limb held straight by means of a plaster cast for about a month, or until the tendons are thoroughly united, after which the necessary apparatus should be applied. The best apparatus consists of a steel waist-band and two steel uprights, one extending from the waist-band down along the outside of the limb, to the bottom of the shoe, and the other extending from the bottom of the shoe to the perineum. Both are jointed at the knee and ankle, and the outside one is also jointed at the hip. The joint at the knee should have a lock so arranged that it will stiffen the joint when the patient stands, and so that he can unlock it when he wishes to sit down, by simply pressing against it outside of the clothing (Fig. 53).

This same apparatus should be applied where there is no deformity, but where the extensor quadriceps is too weak to support the body in the upright position. In such a case a rubber spring can be added to assist the muscle.

In cases where the extensor quadriceps is completely paralyzed, it is advisable to permanently stiffen the joint; this is done by opening the joint and sawing off the joint cartilages as first suggested by Albert. The leg is then put up straight, in a plaster cast, until bony union has taken place. Only a very thin slice should be removed from each bone, so that its growth will not be interfered with. No nails, wires, or anything but the plaster is required to hold the bones in place. Ap. Morgan Vance* has reported seven cases in which he performed this operation. He reports eminently satisfactory results in patients under ten years, but both of his cases over ten died a few days after the operation, from fat embolism. He, therefore, advises that the operation be done only in patients under ten or twelve years of age. The writer's experience has been in young cases, and has been very satisfactory.

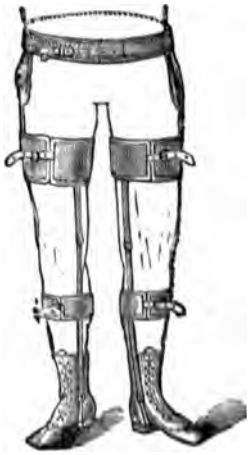
Fig. 53.—Apparatus for support of weak limbs.

Robert Jones,† of Liverpool, reports 26 cases of knee- and ankle-joints operated upon without a mishap; a number of them were over ten years of age. In the knee, he does not do a formal excision, but opens the joint in front, removes the semilunar cartilages, and finally removes the joint cartilages with a thin layer of bone, leaving the crucial ligaments. He reports very satisfactory results.

In cases where all of the muscles of the limb are more or less affected, the psoas and iliacus are unaffected, and can be depended upon to move the limb forward, so that when the joints are stiffened by mechanical or operative means locomotion is possible.

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* "Trans. American Orthopedic Association," vol. vii, p. 268.

† *Provincial Med. Journal*, Dec., 1894, and Jan., 1895.

Deformities of the hip from infantile paralysis are more difficult to treat satisfactorily than those of the other joints, because the whole limb is necessarily involved in the paralysis, and because some of the contracted tendons are so deep-seated that they cannot be easily reached. When weight and pulley will not overcome the deformity at the hip in a short time, all of the superficial muscles requiring it may be cut subcutaneously and the limb forcibly straightened at once; but when the psoas tendon is contracted, it can only be cut by careful dissection through a free opening. When the deep tendons and fasciæ are firmly contracted, it will be found easier and safer to perform an osteotomy just below the lesser trochanter in order to bring the femur into proper position. The limb should then be put in a plaster cast and treated as a simple fracture.

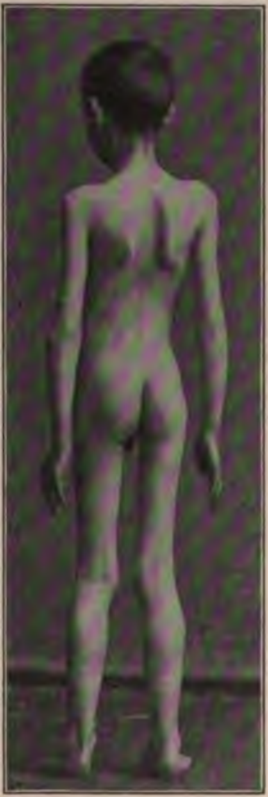

Fig. 54.—Progressive muscular atrophy (W. A. Jones).

Before concluding this chapter, the writer would again insist that patients of this kind who are seemingly hopeless should not be turned away without first having every effort made to better their condition, because by judicious use of all modern methods, both mechanical and operative, much good can be accomplished.

PROGRESSIVE MUSCULAR ATROPHY (Fig. 54).

This disease is of interest to the orthopedist only because it may be confounded with the various paralyses that he is called upon to diagnosticate and treat, particularly when it appears in childhood.

It comes on very gradually, the first symptom being a loss of strength in the part affected. In children, the lumbar muscles and the legs are apt to be first affected, and in adults, the muscles of the thumb, hand, or shoulder. The characteristic feature is the slowly progressing atrophy of the muscles. The disease is to be differentiated from infantile spinal paralysis by the slow onset, the reflexes and electric reactions being normal. The affection may resemble peripheral paralysis due to an injury, but is to be differentiated from the latter condition by absence of a traumatic history.

CHAPTER VII.

INFANTILE CEREBRAL PARALYSIS, OR SPASTIC PARALYSIS; PSEUDOHYPERTROPHIC PARALYSIS.

THERE is little doubt but that the term "spastic paralysis" has been applied to a number of different diseases. Within a few years we have learned to describe a few different conditions, but our knowledge is still very limited.

The palsies, so called, are not always paralyses, but are sometimes spastic contractions without paralysis. The trouble may be hemiplegic, diplegic, or paraplegic. Of 150 cases reported by Osler, 120 were hemiplegic, 19 diplegic, and 11 paraplegic. The hemiplegic cases usually begin within the first three years of life, and a large percentage of them are congenital. Diplegic cases usually begin at birth, from an injury. The paraplegic cases are usually congenital.

Infantile hemiplegia (Fig. 55) often occurs during an infectious disease or an attack of indigestion. It may follow convulsions from any cause. It occasionally follows an injury to the head; and very rarely it comes on in an apparently healthy child. In about half of the cases facial paralysis is present. Strabismus also occurs at times. The paralysis affects motion only. The reflexes are exaggerated. Atrophy is not marked or rapid.

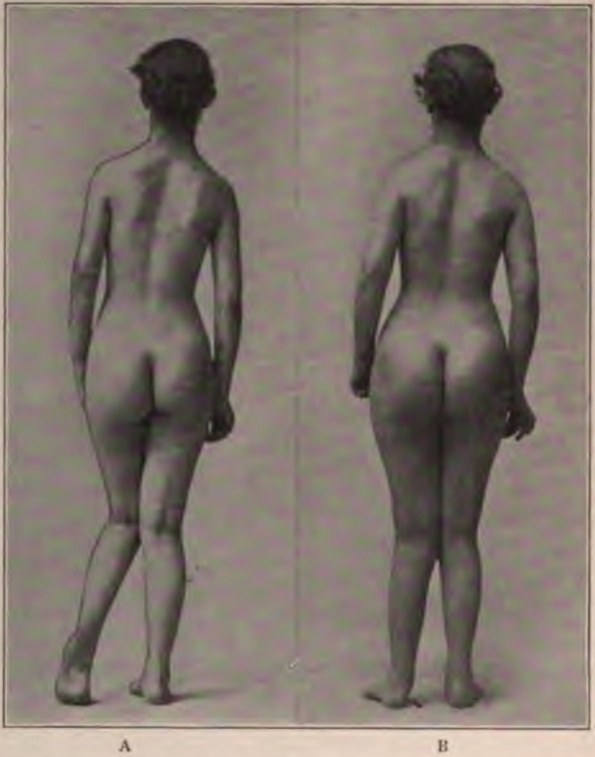

Fig. 55.—A. Infantile hemiplegia. B. Result after tenotomies of contracted tendons.

The muscles may remain soft and flabby, but are more likely to become rigid from "spastic contraction." This rigidity is increased by active or passive motion, but disappears during sleep or under anesthesia. Aphasia is frequently a transient symptom. In the majority of cases there is some mental defect, varying from slight "backwardness" to hopeless idiocy. In some cases the mind is perfectly clear. In nearly half of the cases epilepsy develops after two or three years, or later. While atrophy is not marked, the growth of bone may be interfered with by trophic changes, so that shortening follows.

Late changes are apt to occur in the extremities. The arm becomes flexed and is drawn close to the side. The leg becomes flexed and rigid. Athetosis and chorea spastica are developed.

Bilateral hemiplegia was described by Little as "spastic rigidity of the new born." The pathologic conditions, so far as known, are the same as hemiplegia, save that they are in both sides of the brain, but the clinical history is somewhat different. The muscles of the extremities are in a spastic condition at or very soon after birth. Occasionally they follow fever with convulsions. The arms may be much less affected than the legs. The legs are apt to be crossed, and are quite rigid. Sometimes the spasm is so great as to prevent the patient from walking ; when he does walk, it is with a peculiar, jerking gait, that is quite characteristic. The feet are drawn into an equinus or equinovarus position. There is no atrophy noticeable, and sensation is unimpaired. Reflexes are exaggerated, and electric reaction is normal. Double athetosis and chorea spastica are common. The child is microcephalic, and the mental condition is below par, often amounting to idiocy. The face has an idiotic expression that is worse than the real mental condition would justify. The teeth are frequently poor and deformed and quite prominent. The mouth is kept open, and saliva frequently dribbles from it.

Spastic paraplegia has sometimes been called "spastic spinal paralysis," because brain symptoms are often absent. It resembles lateral sclerosis of adults, and it is probable that some cases are spinal, but as yet no pathology is known for such a condition in childhood, and all cases are classed under the head of cerebral palsies. This affection usually begins at birth, or within the first year of life, but occasionally appears later. It is characterized by a spasmodic rigidity of the muscles of the lower extremities. There is flexion and adduction of the thighs, so that the knees overlap. They yield to firm, steady pressure, but return as soon as the pressure is removed. The child stands with the knees overlapping, or entirely cross-legged. He wears his shoes out under the ball of the foot, on account of the peculiar, shuffling gait, and his clothing is rubbed between the knees. He is backward in learning to walk. There is no atrophy or anesthesia. The reflexes are exaggerated. The upper extremities are affected in the same manner, but to a lesser degree. When head symptoms and idiocy are present, the case is one of diplegia, and should not be described as a paraplegia.

Idiotic children often suffer from a general helpless condition, aptly termed by Bradford and Lovett "incoordination of idiocy," but it does not properly belong to the spastic paralyses, because there is neither paralysis nor spasm present. This condition should be borne in mind, however, when the patient is an idiot, because it has a bearing on prognosis. When he has not brains enough to use the muscles nature has given him, it is folly to expect him to use braces.

Etiology.—Many causes have been assigned for the cerebral palsies of children, only a few of which can be really proven to be such. In 1862 Little wrote a paper in which he endeavored to prove that these cases were all due to difficult labors, and that theory was quite generally accepted for a time; but a number of writers have since reported series of cases, in many of which labor had been normal and easy. In this, as in every other disease of infancy, maternal impressions have been often quoted as a cause. While this may, and undoubtedly does, sometimes act as a cause of mental as well as physical defects in a child, it is very easy to see that in a majority of cases it is a mere fancy upon the mother's part. No mother likes to admit that it is possible for her to give birth to a defective child, and they are all, therefore, very ready to bear positive testimony to a fright or an accident, to account for any possible defect. It is a very common experience for obstetricians to hear a pregnant woman state that she is certain that her child will be marked, on account of some fright or accident, who afterward bears a perfect child, and her fears are forgotten. If such a mother should happen to give birth to a defective child, she and all her friends, the doctor possibly included, would be positive that they fully understood the cause. Some cases are undoubtedly caused by forceps delivery and other injuries to the head. Syphilis may reasonably be mentioned as a cause. A large percentage begin during an attack of an infectious disease. Many cases are preceded by convulsions from various causes, and it is rational to conclude that a hemorrhage occurred in the brain during the convulsive attack which caused the paralysis. That there are many causes of cerebral hemorrhage in children is evident, because in every series of autopsies made upon new-born children a large percentage of hemorrhages is found.

Osler sums up the possible causes of infantile hemiplegia as follows: (1) Hemorrhage occurring during violent convulsions, during a paroxysm of whooping-cough, or at birth; (2) postfebrile processes: (*a*) embolic; (*b*) endo-arterial and peri-arterial changes; (*c*) encephalitis; (3) thrombosis of cerebral veins.

Pathology.—In cerebral paralysis the condition is a lesion of the motor tract of the brain, with retarded development and descending degeneration of the pyramidal tracts and lateral columns of the cord. The condition is much the same in all cases. The original lesion seems to have been due to an embolus or hemorrhage, which has injured the brain tissue. This injury is followed by retarded development. Later, the condition known as porencephalia is frequently developed. In this condition there are numerous cavities or cysts, which cause a corresponding loss of brain tissue. Scar tissue is also present as a result of the early injury to the brain. These cavities and scar tissue are found on the surface and in the deeper parts of the motor tract. When the condition is confined to one side, we have a case of hemiplegia, and when it is on both sides we have a case of diplegia, the difference being one of extent only. From a clinical standpoint, most observers are satisfied that some cases of spastic paraplegia are true spinal spastic paralyses, notwithstanding the fact that, as yet, we have no known pathology for such a condition in childhood. The writer, however, is satisfied that the absence of such pathology is due entirely to the lack of opportunity to search for it, and that the time is not far distant when a pathologic condition similar to lateral sclerosis in adults will be demonstrated in children.

Diagnosis.—The diagnosis of infantile hemiplegia is based upon the paralysis confined to one side, motion only being affected, with exaggerated reflexes and slow atrophy. In paraplegia, or typical spastic paralysis, the muscles are spasmodically contracted, but will slowly yield to pressure ; reflexes are exaggerated, sensation and electric reaction normal. Head symptoms, such as strabismus, facial paralysis, and idiocy are often present.

In cases where all head symptoms are absent, it is rational to make a diagnosis of spinal spastic paralysis.

These affections are to be differentiated from poliomyelitis by the fact that the latter is accompanied by marked atrophy, which has come on rapidly, with reflexes absent, poor circulation, rigid deformity that will not yield to pressure in a short time, and absence of head symptoms.

It may be impossible to differentiate between spastic paralysis and beginning pseudohypertrophic paralysis, but time will make the diagnosis clear.

In paralysis from Pott's disease, other symptoms of the disease, such as pain and deformity, are present, and head symptoms are absent.

Prognosis.—The prognosis of infantile hemiplegia is not very good, because a spastic condition is likely to follow, and epilepsy sooner or later develops in about half of the cases.

In paraplegia, the patient is not likely to be very long-lived, although the disease *per se* has little tendency to destroy life, but the vitality is poor, and he is likely to succumb to comparatively mild attacks of other disease. Most of these patients learn to walk and to talk after a time—often as late as the sixth year. They do both in an indifferent manner, however, when head symptoms are marked.

The writer has seen several cases that he has pronounced spinal spastic paraplegia, because of the absence of all head symptoms, and in these cases the prognosis has been better than in cerebral cases, because they have shown very satisfactory improvement under proper operative and mechanical treatment.

Treatment.—These cases come to the orthopedist after the paralysis is fully developed, so he is not called upon to treat the early symptoms. In fact, the majority of cases come to him after spastic contractions and deformities have developed.

For these conditions, medication is of no value. Electricity and massage are highly recommended by neurologists, and are also employed by orthopedists, but the latter are not content with this treatment alone. Where the mental defect is not too great, much good may be accomplished by muscular education. The muscles and joints should be worked by passive motion, and the patient taught to move them himself. This, with thorough and oft-repeated massage, is of undoubted benefit, but is not to be depended upon to the exclusion of mechanical and operative treatment. Electricity should be applied almost, if not quite, daily, and for from ten to fifteen minutes at a time, the faradic being the current of choice.

Mechanical treatment without operative treatment is not successful. The pressure required to overcome the spastic contraction of the muscles is so great that braces are almost certain to cause pain that the patient cannot endure, and when the deformity can be overcome by this means it immediately reappears upon the removal of the apparatus.

It has often been said that since this is a central trouble, operations upon the extremities are absurd and useless. Theoretically, this would seem to be correct, but practically it has been clearly demonstrated within the past few years that much good may be accomplished by judicious tenotomies and myotomies followed by mechanical treatment. In all recent works upon orthopedic surgery, the latter course is recommended as the one most likely to prove beneficial (Fig. 56).

Gibney, Bradford, Gillette,* Scudder, and Bullard † have all recommended this course and reported successful results following it. Theoretically, no reason can be given for the amount of benefit derived from operative procedures in these cases, but we are bound to accept of practical results. Lee says that even the mental condition is improved by it.‡

In most of these cases the tendo Achillis is contracted, and should be cut in the same manner as described for club-foot. The foot should be at once placed in the normal position, and held there for a couple of weeks by a plaster cast. The hamstring tendons will often be spastically contracted, and should be cut in the same manner as described for infantile spinal paralysis. When the deformity is old and quite fixed, the tendons and fasciæ should be cut through an open wound, the wound in the integument closed with catgut, and a surgical dressing applied. The limb should then be placed in the normal position, and held there by plaster-of-Paris or other convenient means. After tenotomies for this disease, the deformity must not be overcorrected, as in club-foot, because the spasm is present in all the muscles, and the overcorrection would be very liable to become permanent.

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* "Trans. American Orthopedic Association," vol. iii.

† *Ibid.*, vol. iv.

‡ *Ibid.*, vol. iii, p. 23.

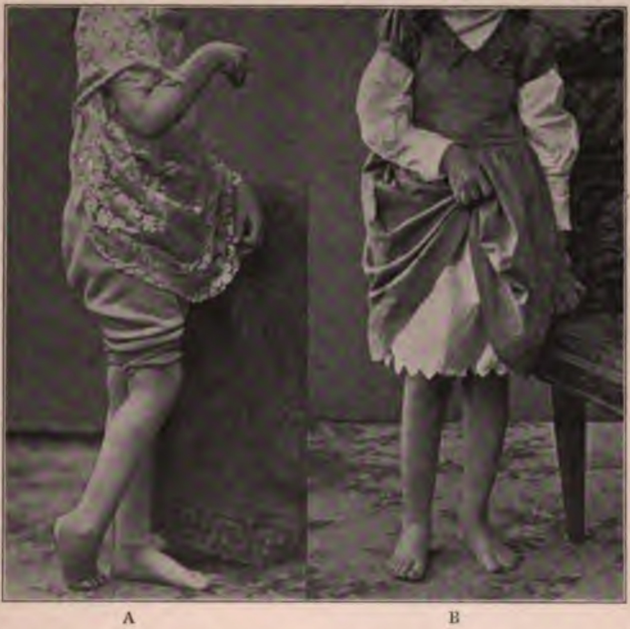
A B

Fig. 56.—A. Infantile cerebral paralysis. B. Result after tenotomies followed by mechanical treatment (Gillette).

After the plaster is removed, a proper mechanical appliance should be worn for some months to prevent a relapse, but may eventually be dispensed with, because the tendency to relapse is not so great as one would naturally expect. These operations are perfectly harmless, and it is very gratifying to see how much the spasm of the muscles is improved after the deformities have been overcome in this way. The treatment should begin with tenotomy, because it is often impossible for the child to place the sole of his foot upon the floor until this is done.

The braces to be used are the same as described for poliomyelitis.

When the mental condition is very bad, there is little to hope for from any form of treatment, because much of our success depends upon educating the child to use his limbs after the deformity has been overcome.

In cases of spinal spastic paralysis the writer has obtained some very satisfactory results from this treatment.

It remains yet to be demonstrated whether any good can be accomplished by brain operations in these cases. Since the condition is usually one of porencephalia, it does not seem probable that opening the skull can do any good; but since we can accomplish so much by seemingly irrational tenotomies, we should not be too hasty in our conclusions with reference to brain operations.

Much good has been accomplished in this way for microcephalics, and may yet be for porencephalics.

In traumatic cases and cases in which epilepsy is prominent, brain operations are, to say the least, justifiable. Very few operations have yet been reported, and the results are anything but flattering; but in cases so seemingly hopeless as some of these, any procedure that offers a shadow of hope should be resorted to.

PSEUDOHYPERTROPHIC PARALYSIS

is a disease of childhood characterized by a progressive weakening of the legs, accompanied by an apparent hypertrophy of the muscles.

Etiology.—The disease begins under the age of ten, and is much more frequent in boys than in girls. A large percentage of cases are hereditary, usually from the mothers. Injury and acute diseases sometimes act as exciting causes.

Symptoms.— The first symptoms are a peculiar waddling gait, with progressive weakening of the legs. After a time the enlargement of the muscles begins. The calf muscles, the thigh extensors, and the gluteal muscles are usually most affected. In the upper part of the body, the infraspinatus is most frequently affected. The deltoid and supraspinatus may be affected. These hypertrophies are usually accompanied by atrophy of the pectoralis major and the latissimus dorsi, which causes a characteristic appearance (Fig. 57). From the beginning, certain groups of muscles atrophy, and later atrophies take the place of the hypertrophy. The child experiences difficulty in going upstairs or in rising from a horizontal position. When standing, the spine assumes the position of lordosis, which is replaced by kyphosis when the child sits.

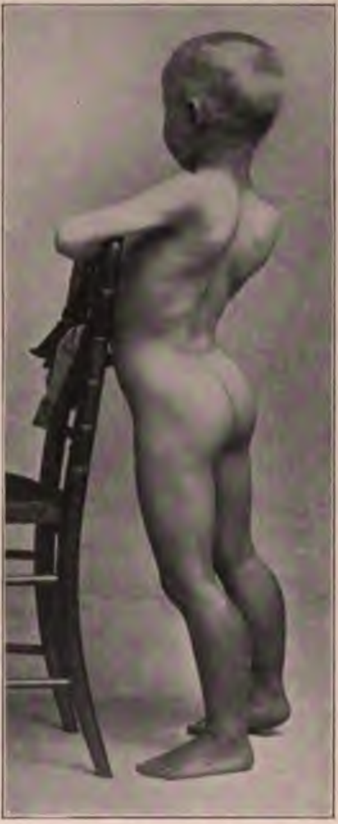
Fig. 57.—Pseudohypertrophic paralysis (W. A. Jones).

Later, talipes equinus may develop, and the reflexes disappear. There is no pain, and the intelligence is usually good. The amount of hypertrophy varies greatly in different cases. In some cases it is very marked, and in others it is barely perceptible. The hypertrophied muscles have a peculiar, hard, non-elastic feeling, very unlike normal muscular tissue.

Pathology.—The change is a degenerative one, for although at first there is some hypertrophy of muscular fibers, there is a gradual increase of connective tissue, with corresponding muscular atrophy. In some cases there is a marked deposit of fat in the connective-tissue cells.

Diagnosis.—The diagnosis in a well-marked case is based upon the peculiar gait, the large calves, and the peculiar shape of the shoulders, caused by hypertrophy of the infraspinatus muscles, with atrophy of the pectoralis major and the latissimus dorsi.

Prognosis.—The disease may come to a standstill, but the patient does not recover, although he may improve slightly. The disease usually progresses gradually for many years. Persons who were afflicted with it from childhood have been known to live to be over fifty years old. Death occurs from exhaustion or some intercurrent affection.

Treatment.—The disease is incurable, but it can be somewhat retarded, and by proper operative treatment the patient may be able to walk much longer than he otherwise would. Medicines and braces are worthless in this disease. Electricity is of doubtful utility, but massage and gymnastic exercises are of undoubted value.

When the tendo Achillis or the hamstring tendons become contracted, as they are liable to, tenotomies should be performed in the usual manner, and the parts placed in the normal position and held there until union has taken place.

CHAPTER VIII.

TALIPES, OR CLUB-FOOT; WEAK ANKLES.

Talipes is a term applied to deformities of the foot due to a deviation from its normal anatomic relation to the leg, whether that deviation be in an anteroposterior or a transverse plane. The deformity may be either congenital or acquired. There are four principal varieties: (1) Talipes varus (see Fig. 58), in which the sole of the foot is turned inward; (2) talipes valgus (see Fig. 59), in which the sole of the foot is turned outward; (3) talipes equinus (see Fig. 62), in which the toes drop and the heel is elevated; (4) talipes calcaneus (see Fig. 64), in which the toes are elevated and the heel depressed.

Other varieties sometimes seen are talipes cavus (see Fig. 65), in which the anteroposterior arch of the foot is increased; talipes planus, in which the arch is diminished; and the non-deforming club-foot of Shaffer, which is simply an incomplete equinus. The simple varieties of club-foot are comparatively few, the vast majority of all cases being a combination of two of the simple varieties. These compound varieties are named by combining the names of the varieties composing them—for example, the most common variety of club-foot is a combination of equinus and varus, and is called equinovarus.

In the normal foot there are two arches, anteroposterior and transverse, which give to the foot elasticity and strength. Any interference with these arches has a tendency to make the gait stiff and unnatural. The astragalus is the keystone to both of these arches, and is more or less deformed or misplaced in all varieties of club-foot.

The mediotarsal-joint, formed between the os calcis and astragalus behind and the cuboid and scaphoid in front, divides the foot into two parts. The front, or foot part, is called the "pes," and the back or ankle part the "talus." In simple equinus or calcaneus the deformity is mostly in the ankle-joint, but the lateral deformities are mostly in the joint between the pes and talus. The ankle-joint admits of no lateral motion except in extreme extension, and in this position it is very slight.

Talipes Varus (Fig. 58).—The feet of new-born children very commonly assume the position of simple varus, but as a pathologic condition it is very rare. The deformity is at the mediotarsal-joint, and is an adduction and outward rotation of the pes or anterior portion of the foot. Varus, in combination with equinus, forms equinovarus, the most frequent variety of club-foot.

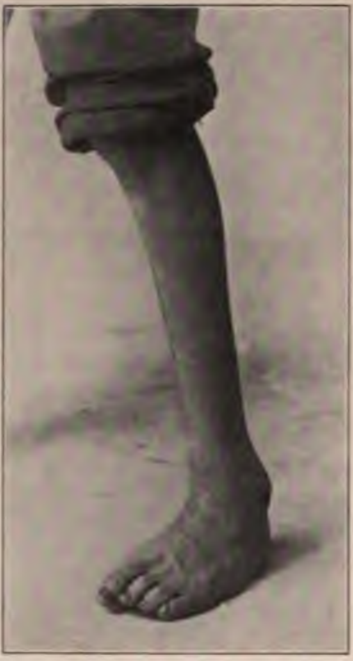

Fig 58.—Talipes varus.

Talipes Valgus (Figs. 59 and 60).—This variety is much more frequent than varus, both as a congenital and as an acquired deformity. It consists of a turning outward of the foot, with prominence of the scaphoid and astragalus on the inner side, and breaking down of the arch of the foot. The acquired is much more common than the congenital variety. Acquired valgus is usually classified according to its cause—for example, we have static, traumatic or inflammatory, rachitic, and paralytic varieties. Static valgus, or flat-foot, is the most frequent variety. It usually occurs in young adults, and is due to a lack of balance between the weight of the body and the strength of the foot. Many ingenious theories have been advanced concerning the cause of acquired valgus, but it is very evident that it

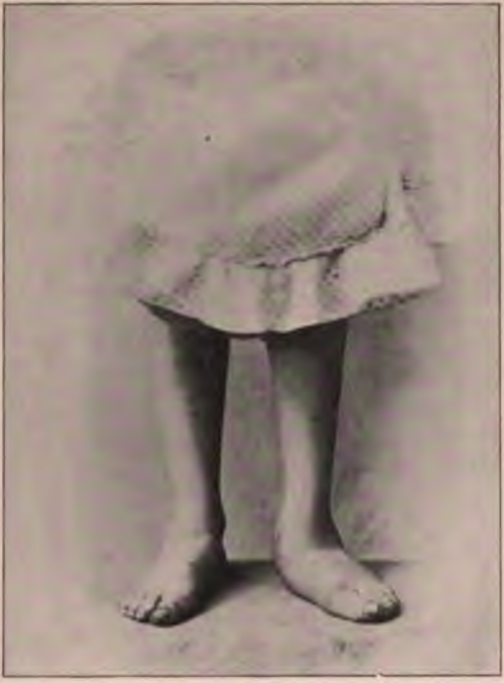

Fig. 59.—Talipes valgus.

is simply a breaking down of the arch of the foot, since it occurs in persons who bear heavy burdens (peddlers), in those who are obliged to stand constantly (barbers), or in those who are obliged to stand in such a position that the weight of the body is thrown on the inner side of the foot (bakers).

Traumatic or inflammatory flat-foot, often called spurious flat-foot or acute flat-foot, may be due to Pott's fracture, inflammation of the ankle-joint, or injury of the peroneus longus. This variety of valgus is very frequently spoken of as inflammatory, because it is characterized by severe pain. The condition, however, is not one of active inflammation, since suppuration never occurs. The tenderness is

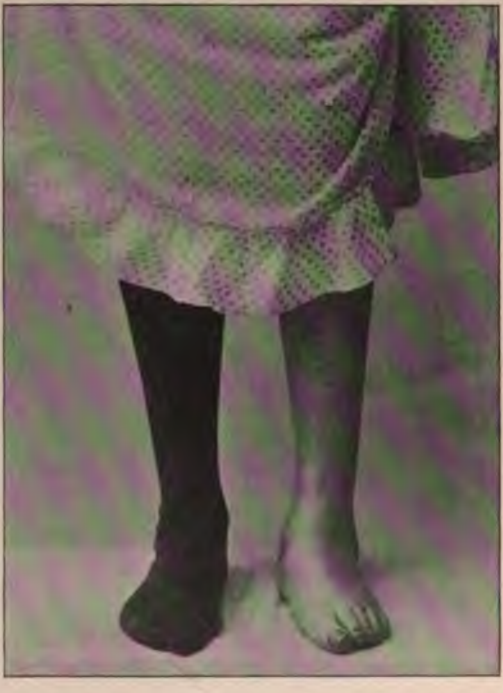

Fig. 60.—Result after removal of astragalus in case represented in figure 59.

due to abnormal pressure. On account of the pain and tenderness, this affection has often been diagnosticated and treated as rheumatism, or inflammation of the tarsal bones. The gait of one suffering from this affection is peculiar and characteristic: the toes are everted, the inner side of the foot touches or approaches the floor, the knees are in a valgoid position, and he steps in a hesitating, uncertain manner, indicative of tenderness or pain. The painful points in flat-foot are on the lower and inner side of the astragalus, at the base of the first and fifth metatarsal bones, and sometimes just in front of the outer malleolus. The pain is not necessarily in proportion to the amount of deformity, those cases showing the least deformity often being the most painful. These patients all tire easily, and are often unfitted for active employment. Fortunately, the prognosis under proper treatment is quite favorable (Fig. 61).

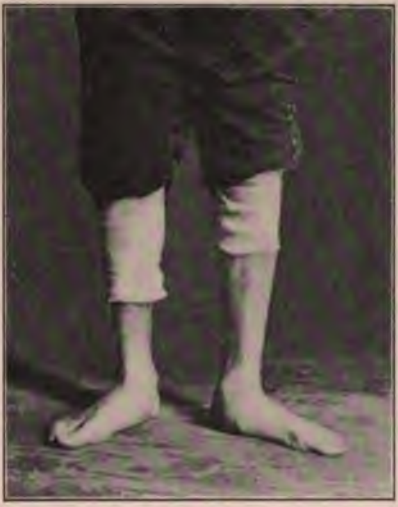

Fig. 61.—Typical flat-foot (Gillette).

The paralytic variety of valgus is due to poliomyelitis.

In rachitis, valgus is very common and is usually accompanied by knock-knee, either as cause or effect.

In children, the arch of the foot does not begin to form until after the first year. Weak ankles of children are really a form of valgus due to lack of development of the arch and to weakness of the tibialis anticus, tibialis posticus, and plantar muscles. These children are free from pain, but have a characteristic gait, and frequently fall and sprain the ankle.

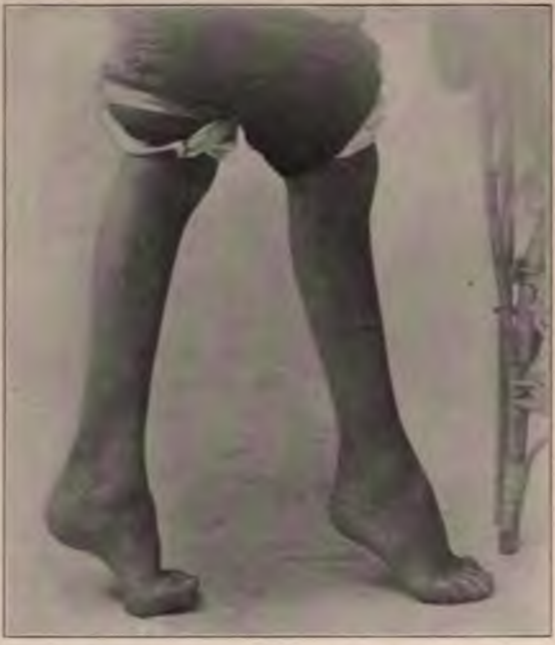

Fig. 62.—Talipes equinus of fourteen years' standing.

The anatomic changes in congenital and acquired valgus are practically the same. There is little change in the shape of the bones, but their relations are somewhat changed, the arch of the foot is broken down, and the foot is turned outward. In severe cases the outer malleolus becomes atrophied and the inner one more prominent. Motion in the ankle-joint becomes limited. In inflammatory flat-foot the bones may become eroded from pressure, and in old cases the astragalus and scaphoid may become united by a new deposit of bone. The calcaneoscaphoid and calcaneo-astragaloid ligaments are elongated in all cases.

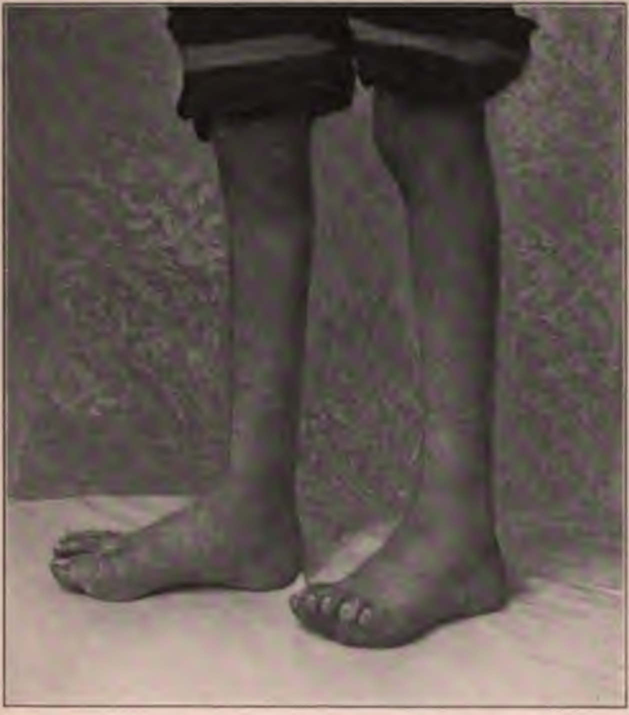

Fig. 63.—Result of treatment in case represented in figure 62.

The muscles passing around the inner malleolus are weakened but not paralyzed.

Talipes Equinus (Figs. 62 and 63).—This variety is quite common as an acquired deformity, but is very rarely congenital. Its most frequent causes are poliomyelitis and spastic paralysis. It is also caused by injuries and inflammation. In the majority of cases there is very little change in the bones. In severe cases the scaphoid becomes subluxated, and the astragalus is quite prominent on the dorsum of the foot.

Talipes Calcaneus (Fig. 64).—This deformity is rarely congenital, but more frequently acquired. It is the opposite of equinus, and is usually due to infantile paralysis. It may be due to rupture of the tendo Achillis or other injuries. It is most frequently seen in conjunction with valgus, forming talipes calcaneovalgus. The anatomic changes are usually very slight aside from the paralysis of the muscles.

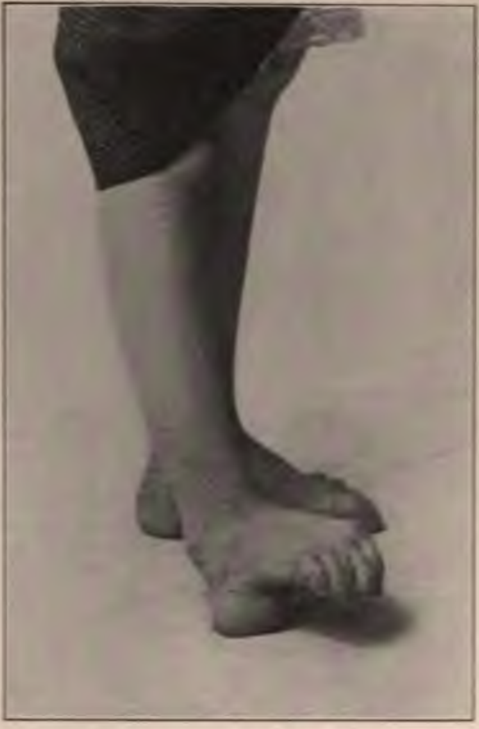

Fig. 64.—Talipes calcaneus due to infantile spinal paralysis.

Pes cavus (Fig. 65) may be either congenital or acquired, but rarely the former. It consists of exaggeration of the arch of the foot, and is usually caused by paralysis of the muscles of the calf. It may be caused by the contraction of the plantar fascia, the tibialis anticus, and peroneus longus. It is a frequent complication of equinovarus.

Pes planus is the opposite of cavus, and differs from valgus in that there is no eversion of the foot. The bones are unaltered, the sole anatomic change being the lengthening of the ligaments allowing the tarsal bones to rest upon the floor.

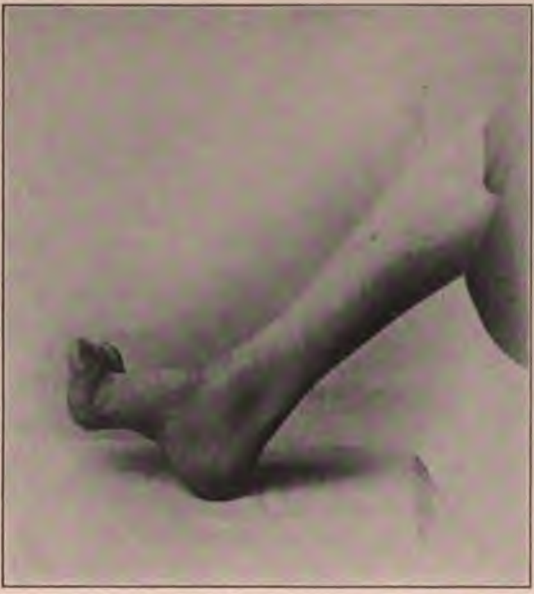

Fig. 65.—Pes cavus due to infantile spinal paralysis.

Non-deforming Club-foot.—Dr. Shaffer describes this variety as one in which "all the conditions found in certain forms of talipes exist, with the exception of exaggerated deformity." It may occur at any age, but usually occurs in young and rapidly growing females, and frequently accompanies scoliosis. The prognosis is usually good.

Equinovarus (Fig. 66).—This is by far the most common variety of club-foot, and is a combination of varus and equinus. It may be either congenital or acquired. It is the typic variety of congenital club-foot, and the one upon which all principles of treatment are based. The tendo Achillis is contracted and the heel atrophied. The plantar surface is shortened and turned inward, and the toes point downward. The inner malleolus is smaller and the outer one larger than normal. There is a decided deformity at the mediotarsal joint. The astragalus projects on the dorsum of the foot, and in old cases bursæ and large callous spots are found on the convex side. The scaphoid articulates with the side instead of the anterior surface of the astragalus, and may even articulate with the inner malleolus. The astragalus is badly deformed, and rotates forward on its horizontal axis, so that a portion of its upper articular surface is prominent on the dorsum of the foot. The neck of the astragalus, instead of projecting forward, projects for-

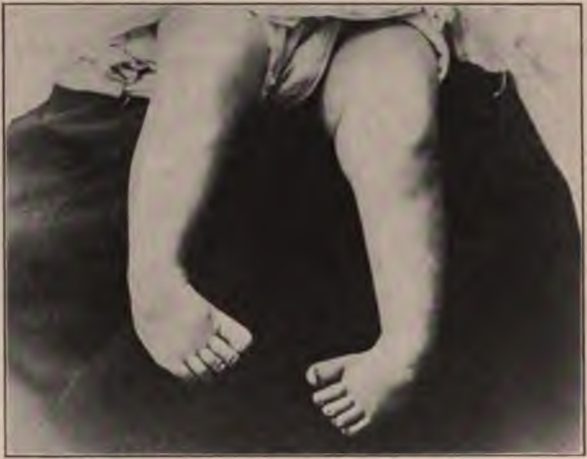

Fig. 66.—Talipes equinovarus.

ward and inward. The calcaneum is changed from a horizontal to almost a vertical position. The tibialis anticus and common extensor tendons are misplaced. The muscles that are overstretched are atrophied but not paralyzed. The whole limb is atrophied, and the tibia and sometimes the femur are misshapen. The internal and lateral ligaments and the plantar fascia are always contracted.

Acquired equinovarus may be caused by infantile or spastic paralysis and by inflammations or injuries. The most common variety is that caused by infantile paralysis, in which the foot is flabby, cold, and blue. The whole limb is atrophied, and some of the muscles paralyzed.

Talipes Equinovalgus.—This variety occurs both as a congenital and an acquired deformity. It is a simple combination of equinus and valgus, and needs no special description.

Talipes calcaneovarus occurs as a congenital affection, and is said to occur as an acquired deformity, but the writer has never seen a case. The deformity is a combination of simple calcaneus and varus without any special features.

Talipes calcaneovalgus is met with both as a congenital and as an acquired deformity, and is a combination of simple calcaneus and valgus.

Hysteric Club-foot.—It is well to remember, in making a diagnosis of club-foot, that in hysteric females a chronic spasmodic contraction of some of the muscles of the leg sometimes occurs, simulating club-foot.

Causes.—That we do not know definitely what the causes of congenital club-foot are, is demonstrated by the fact that no two writers agree exactly upon the subject. The right foot is more frequently affected than the left, both feet more commonly than one foot, and males oftener than females. Many among the laity, and a few in the profession, believe maternal impressions to be the great cause of this and other congenital deformities, but there is no rational evidence of any such relation between what a woman sees and what she brings forth. Heredity undoubtedly does account for some cases, but cannot possibly account for all.

Little, the father of orthopedic surgery in England, taught that congenital club-foot is caused by some pathologic change affecting the child *in utero;* for example, that it suffered from a meningitis or a myelitis causing paralysis of certain groups of muscles ; but this theory is not borne out by fact, since the muscles retain their normal electric reaction, and the microscope fails to reveal evidence of any pathologic changes. A theory having many advocates is, that the deformity is due to arrest of development, particularly in the astragalus and tarsal bones ; but it seems more rational to consider these changes secondary and due to pressure. It is believed by many that this deformity is due to mechanical pressure *in utero*, but this is only another theory without substantial proof. The most rational theory, in fact the only one based upon scientific research, is that of Dr. Berg, of New York, which is spoken of as the non- or retarded-rotation theory. By embryologic investigations he has demonstrated that at a certain stage of development all fetuses are club-footed, and that this condition is overcome by a rotation inward of the whole extremity. It naturally follows that any failure in rotation would leave the child club-footed. This theory, however, is only applicable to equinovarus, leaving the others unaccounted for. The etiology of the acquired forms is much better understood. The vast majority of them are paralytic, and most of the others are traumatic. The most frequent central cause of paralytic club-foot is poliomyelitis. Among the many traumatic causes may be mentioned fractures, burns, and cuts. Certain vocations—for example, peddling and baking—frequently cause valgus or flat-foot.

Diagnosis.—The unsightly deformity and peculiar gait are ordinarily sufficient evidence upon which to base a diagnosis. A mistake may be readily made, however, in cases of non-deforming club-foot, unless a careful examination be made. In this variety it will be found that the ankle cannot be flexed beyond a right angle.

Prognosis.—Notwithstanding the fact that failure in the treatment of club-foot is very common, the prognosis in all but paralytic cases should be favorable. Congenital club-foot can and should always be cured. There is a belief among the laity, and even among some medical men, that many cases cannot be cured, but this belief is founded upon experience with old methods, or with new methods in incompetent hands. When mechanical methods alone were depended upon failures were not infrequent, but with modern methods combining operative and mechanical means there should be no failures. This deformity without treatment continually grows worse, so that any hope that a child may "grow out of it" will certainly be followed by disappointment. There is also a persistent tendency to relapse, and in order to overcome this tendency the deformity in every case should be over-corrected. Mechanical appliances must always be used to prevent relapse. "Half cures are no cures," and no surgeon should allow a case to pass from his hands until the deformity is entirely overcome, for relapse will surely follow. It is folly to perform a series of tenotomies and then apply a club-foot shoe, expecting it to do the rest.

Club-foot shoes have done more harm than good by raising such false hope. The club-foot shoes kept in stock by instrument-makers are relics of past ages, and are not to be recommended. Walking appliances are to be used *after the case is cured* to prevent relapse. The time necessary to cure an average congenital case is from three weeks to three months; but in exceptional cases, or cases that have relapsed or been long neglected, it may require six months or a year.

The prognosis in paralytic cases, whether spinal or cerebral, is not nearly so good as in other varieties, but much can be done for them.

Treatment.—The modern treatment of club-foot differs very materially from that in vogue a few years ago. The old idea was to gradually overcome the deformity by continuous pressure or leverage by means of mechanical appliances. The modern idea is to overcome the deformity quickly by surgical or mechanical means, or both, and then apply an apparatus to prevent a relapse. The older plan is very good for mild cases, but in severe or complicated cases it is too slow and often fails. It is the height of folly to pull and stretch at a tendon or fascia for weeks, months, or years, when the deformity can be overcome in a minute by a knife. While it is true that the deformed bones cannot be changed quickly to their normal shape, the sooner they are placed in their normal position the sooner will they shape themselves to the new order of things.

The indications are, first to overcome the deformity, and second to prevent a relapse. There are many ways by which these indications may be met. The object of the writer is not to give in detail all of these methods, but to lay down the principles of treatment, and to give in detail such methods as he has found from actual experience will carry out these principles satisfactorily. It will be found that these methods are in accord with those of the majority of modern teachers and writers.

The proper time to begin treatment is as soon as the surgeon can get control of the patient. It is not well to have a stereotyped rule by which all cases are to be treated. Each case should be a law unto itself, and have applied to it the method or methods best adapted to the requirements of that particular case. Very mild cases may be treated by simply overcoming the deformity with the hands and holding the foot in an overcorrected position by some mechanical means until all tendency to relapse has disappeared.

The next severer class of cases can be best treated by tenotomizing certain tendons before applying the manual force and retentive appliance. Another class will require, in addition to the foregoing, cutting of fascia and ligaments, either subcutaneously or through an open wound. In certain cases where the resistance to replacement seems to be in the bones and ligaments, rather than in the soft parts, after tenotomizing the resisting tendons the deformity may be overcome by great force applied by machines made for that purpose. And, finally, all other methods failing, bone operations should be resorted to. In a certain number of these cases the astragalus may be removed to advantage, and in others an osteotomy through the neck of the astragalus or the removal of a wedge-shaped piece from the convex side of the tarsus may be necessary.

One experienced in the treatment of talipes will soon decide what course of treatment is best adapted to a given case. A beginner should not be too hasty in his conclusions, but should always consider the milder courses of treatment first, as they are the ones applicable to the vast majority of cases. It is very rarely, indeed, that heroic surgery is necessary in the treatment of club-foot; but when milder measures are insufficient it is the duty of the surgeon to do whatever is necessary to overcome the deformity.

When the deformity can be easily overcome with the hands alone, the probabilities are that by holding the foot in an overcorrected position for a sufficient length of time, by mechanical means, tenotomy will not be necessary. If the deformity cannot be overcome easily with the hands, tenotomy should be resorted to at once. The foot must then be immediately placed in an overcorrected position and held there by mechanical means. The old way was to put the foot up in the deformed position and gradually overcome the deformity later. Some English surgeons still pursue that method, but the writer knows of no one in America who does. Nature fills the space between the cut ends of the tendons with a blood-clot at first, and later, by cell proliferation new tendon is formed that cannot be distinguished from the original. Those who practise the old method say that there is danger that non-union may follow, but this is a purely theoretic objection, for as a matter of fact in does not occur.

Tenotomy is a very simple operation, but every antiseptic precaution should be exercised, for the very fact that it is a simple operation makes suppuration altogether inexcusable. This is not an extremely painful operation, and in patients who are old enough to choose for themselves it may be performed without an anesthetic ; but in young children it is cruel not to give one. Chloroform is perfectly safe, and, barring some special contra-indication, should always be given. A few drops upon a napkin will be sufficient.

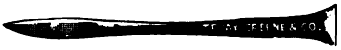

Fig. 67.—Author's tenotome, full size.

The ordinary tenotome found at the instrument-maker's is unfit for use. It is too long, too wide, and too sharp-pointed. The length of the blade leaves a cutting edge bearing against the skin when the tendon is being cut. A long sharp point is unnecessary, and is liable to cut some anatomic structure that is better uncut. The blade of the tenotome should be rather dull-pointed, narrow, and should have a cutting edge not over half an inch long. When operating upon an infant, a still shorter blade is better. The shank of a tenotome should be rather long, and strong enough so that it will not bend or break. The handle should be so constructed that the operator can tell which way the cutting edge is directed when the blade is buried in the tissues (Fig. 67). When about to perform a tenotomy the tendon should be put upon the stretch by an assistant grasping the foot, the skin at the point punctured should be pushed a little to one side by the thumb of the operator so as to form a valve-like opening, and the blade of the tenotome passed underneath the tendon flatwise. The cutting edge of the blade should then be turned toward the tendon and with a slight sawing motion the tendon is cut from within outward. If the thumb of the operator be placed over the tendon at the seat of operation it will facilitate matters very materially. A small pad of sterilized gauze or cotton should be placed over the wound and a roller-bandage applied. In localities where no important nerves or arteries are near the tendon, it can be cut from without inward by passing the tenotome between it and the skin.

The most convenient and altogether the best retentive appliance after tenotomy is a plaster-of-Paris bandage. It should be applied over the other dressings, and while it is setting the foot must be placed in the desired position and held there until the plaster is thoroughly hardened, which will be in from three to five minutes when good plaster is used. It should extend from the point of the toes well up to the knee, being careful not to extend it high enough to chafe the popliteal space when the knee is flexed. This dressing should remain about ten days, when it should be removed and another one applied without the cotton or dry roller. When one is not skilled in the use of plaster it is safer to apply the dry roller underneath ; but in skilled hands it is more convenient and better to anoint the skin with vaselin and apply the plaster without the roller. In applying plaster to a club-foot the foot should be held as nearly as may be in the correct position while the plaster is being applied, for if it be applied with the foot in the deformed position, when the deformity is overcome wrinkles will form on what was the convex surface, which will cause the patient suffering and may cause a slough. After tenotomy it is often necessary to apply considerable force to overcome the deformity. Ordinarily, sufficient force can be applied by the surgeons' hands alone, but exceptionally in young cases and more frequently in old or relapsing cases, it will be necessary to apply greater force by means of machines made for the purpose. The writer is prejudiced in favor of manual force, for by persistent effort with the patient under chloroform he has rarely failed to accomplish the desired result by this means alone. By constant practice one gains great strength in his hands, and he can feel perfectly certain that he is doing no harm. Very often it is possible to overcome the whole deformity at one sitting, even in cases that offer considerable resistance at first. It is desirable to overcome it at once, if possible, by this means; but it is safer and better to make repeated efforts at different sittings in this way than to resort too soon to machines or severe cutting operations. It is astonishing, however, to see what an amount of pressure can be borne for a short time without doing harm. Whatever the amount of deformity to be overcome at any one sitting, it should be overcome before the plaster is applied, so that when it is applied a comparatively small amount of pressure will be necessary. Plaster should never cause a slough, and never will when properly handled. If an operator applies the plaster first and force afterward, he should expect trouble, for he will surely have it.

The beginner must clearly understand the difference between the old and the new way in order to handle these cases comfortably and satisfactorily, for the old way was to use an appliance for the purpose of overcoming the deformity, and it was expected that a long time would be required to bring about the desired result; while the new way is to overcome the deformity quickly by using whatever force is necessary, and to make use of appliances only to prevent relapse. Any attempt to overcome the deformity by strong pressure continued for any length of time would surely be disastrous.

When treating a case with plaster-of-Paris the casts should be changed about once a week until the foot no longer returns to the deformed position upon removal of the cast. In a few cases the little foot and leg will be so fat, round, and soft that a bandage applied in the usual way will slip off. In these cases the bandage should extend half way up the thigh, with the knee partly flexed. At this stage of the treatment a plaster cast heavier than usual can be applied and be allowed to remain for a month, after which a walking-brace should be applied. When the patient is old enough he will walk upon the plaster cast very easily.

Some modification of Scarpa's shoe is the usual walking appliance used. The writer usually employs a light steel brace covered with soft leather that will fit inside of an ordinary shoe (Fig. 68). It consists of a sole, an upright or uprights, and a band reaching half way around the leg just below the knee, all made of soft steel so that they can be bent to fit the case. The uprights extend up the inside, outside, or both, according to the needs of the case. A strap covers the band and encircles the limb just below the knee. The sole has an attachment extending around the side of the foot at the base of the toes, on the inner side for varus and on the outer side for valgus. The sole is placed at such an angle to the upright as to hold the foot in a slightly overcorrected position. An ordinary pair of shoes large enough to cover the foot and the brace are made to lace from the points of the toes. It is not necessary to go to the expense of having a special shoe made, since an ordinary wide-sole, spring-heel shoe, or for infants an ordinary baby shoe, can be made to answer the purpose by

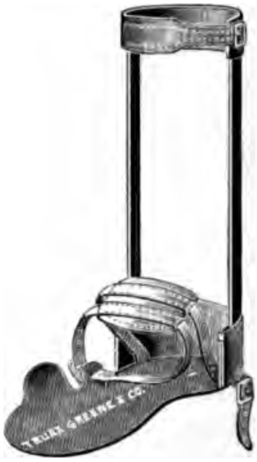

Fig. 68.—Retention shoe for preventing relapse in club-foot.

splitting it down to the toe and putting in a row of eyelets on either side. The surgeon can have his assistant make the change, or, if necessary, can make it himself in a very few minutes. The shoe should be laced tight enough to hold the foot well down on the steel sole. For cases almost well, or that show little tendency to relapse, it will be better to apply the above-described brace outside of a soft baby shoe or moccasin by means of straps for night wear only, and for day wear attach the upright to the bottom of a good heavy-sole shoe, dispensing with the steel sole (see Fig. 74). An appliance should be worn day and night as long as the foot shows any tendency to assume the deformed position. As soon as it seems to be well, the night shoe can be omitted, but the walking attachment to the shoe should be worn for six months or a year longer.

Sole-leather, felt, and gutta-percha have been recommended as retentive appliances, but are greatly inferior to plaster. Many orthopedists employ steel braces such as those previously described from the first, bending them to fit the foot as its shape changes, and in skilled hands they are very efficient. General practitioners and beginners, however, will frequently succeed with plaster-of-Paris where they would utterly fail with braces.

The above-outlined treatment will be sufficient to cure any ordinary case of club-foot. When there is a failure, it is not due to the method, but to faulty application or to lack of perseverance. In old or relapsing cases it will frequently be necessary to resort to operative measures. The operations to be recommended are open incision or Phelps' operation, removal of the astragalus, and removal of a wedge-shaped piece of the tarsus regardless of anatomic divisions.

Paralytic Cases require the application of the same principles as the other variety, but the prognosis is never so good, and special provisions need to be made to replace the paralyzed muscles by mechanical means. The circulation is always poor in these cases, and special care must be exercised less the pressure of appliances cause a slough. Massage and electricity should be used to benefit the circulation, and in infantile paralysis they will help restore the muscles whose nerve centers are not entirely destroyed. By judicious use of wire springs and rubber bands much can be done for these unfortunate cases.

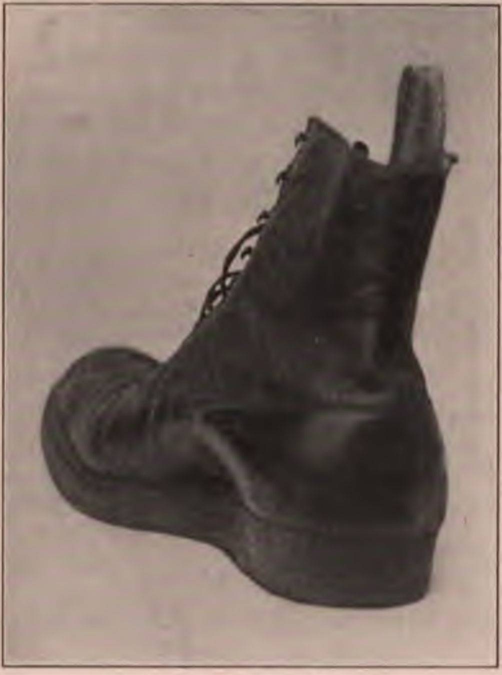

Fig. 69.—Shoe for valgus.

Treatment of Special Varieties.— **Varus.** —Nothing special need be said of the treatment of this variety, since it is broadly discussed under the head of Equinovarus.

Valgus (see Figs. 59, 60, and 61).—The treatment of mild cases of acquired valgus or flat-foot consists of massage and electricity to the peronei muscles and support of the arch of the foot. A very efficient way of supporting the arch, particularly in working-men, is to build up the inner side of the sole of the shoe, so that it rests upon the floor throughout its length and is a little higher than the outer side (Fig. 69), thus throwing the weight of the body more to the outer side. The best mechanical device for treating these cases is that of Dr. Royal Whitman, of New York * (Figs. 70, 71, and 72).

A plaster cast of the foot is made and marked A, B, C, D, and a pattern constructed as follows :

"The point C is taken beneath the ball of the great toe, just short of its bearing center ; a point D just short of the bearing center of the heel-bone, beneath its inner tuberosity, so that the foot may rest upon its natural supports ; A, just above the head of the astragalus, a little in front and below the internal malleolus. These three points are now connected by a gradually ascending line from C, rising above the inner border of the foot, a little in front of the internal cuneiform bone, curving upward above the scaphoid, meeting at A the line drawn upward from D. A curved line is drawn three-quarters of an inch in length, whose center corresponds to a point B on the outer aspect of the foot just above and behind the tuberosity of the fifth meta-

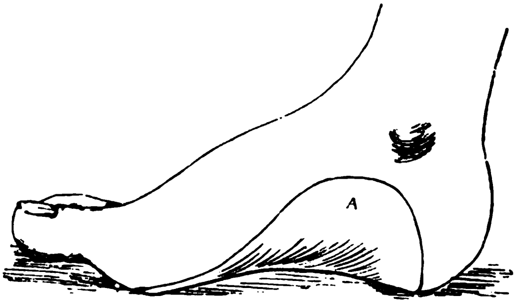

Fig. 70.—Whitman's brace for flat-foot.

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* See "Trans. American Orthopedic Association," vol. i, p. 122.

tarsal. The extremities of this line are now connected with C and D, and the pattern is complete."

The brace should be made of thin tempered steel accurately molded to the cast. When covered with hard rubber this makes a comfortable and durable appliance.

In severe cases of flat-foot it is necessary to overcome the deformity as much as possible before applying a brace, because the patient cannot bear support where he needs it most. This is best accomplished by giving an anesthetic and forcibly bending the foot over the operator's knee and then applying a plaster cast. It may be necessary to continue wearing the cast a number of weeks before a brace can be applied, but the time is well spent, as the results are quite satisfactory.

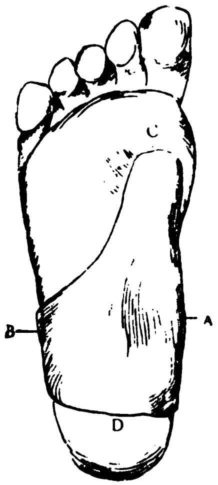

Fig. 71.—Whitman's brace for flat-foot.

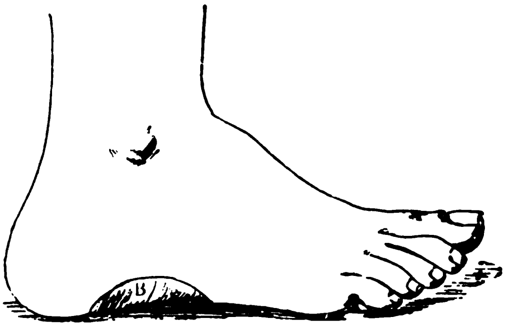

Fig. 72.—Whitman's brace for flat-foot.

Inflammatory Flat-foot.—Cases of inflammatory flat-foot are commonly called rheumatism and treated accordingly. These affections bear no resemblance to each other except that both are painful. It should be borne in mind that a person may be suffering severely from inflammatory flat-foot who has comparatively little deformity. If the patient has no rheumatism elsewhere, it probably does not exist in the feet. In flat-foot the tender points on the inner side of the foot, and sometimes just in front of the outer malleolus, together with more or less breaking down of the arch, will establish the diagnosis.

In many of these cases building up of the shoe, or a Whitman's brace, will render prompt and permanent relief, but in severe cases it will be necessary to straighten the foot under anesthesia and apply a plaster cast as previously described, following with proper support.

Equinus.—Treatment of this variety is described under Equinovarus.

Calcaneus.—Congenital calcaneus seldom requires more than massage and a light brace made with a lock joint so that it will not flex beyond a right angle. Occasionally tenotomy of tendons flexing the foot upon the ankle may be necessary, followed by proper retention apparatus (Fig. 73).

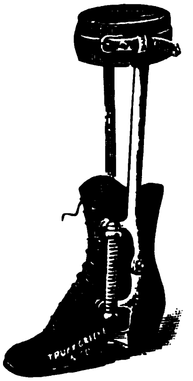

Fig. 73.—Apparatus for calcaneus.

Equinovarus.—In treating this deformity it may be necessary to tenotomize the tibialis anticus and the tendo Achillis, and occasionally the tibialis posticus and the plantar fascia. The tibialis anticus tendon may be felt in the concavity of the deformity on the inner side of the foot, and should be cut about two inches above its insertion. The tendon should be crowded over toward the tibia by the left thumb of the operator and cut by slipping the tenotome under it.

The tendo Achillis should be cut by putting it upon the stretch and passing the tenotome under it, preferably from the inner side between it and the posterior tibial artery. This artery has been cut, but it is not a serious matter and can usually be controlled by pressure. The tibialis posticus should be cut through an open wound along the posterior border of the tibia, just above the inner malleolus.

The tendon comes readily into view, and can be lifted with a hook and cut with scissors. The plantar fascia can be cut by passing a fascia knife (a long-bladed tenotome) between the skin and the fascia from the inner side. With a gentle sawing motion every portion of the contracted fascia should be severed, when the foot will be felt to straighten. The plantar artery is not very likely to be injured, but if it is pressure will control it.

It is very important in treating this deformity to overcome the varus before cutting the tendo Achillis, because it fixes the heel and enables the surgeon to unfold the foot. If this tendon be cut first, then force applied to the sole of the foot will overcome the equinus; and the varus, which is by far the more serious part of the deformity, will remain. Most of the failures that have come under my observation have had the tibialis anticus and tendo Achillis cut at one sitting, and some form of club-foot shoe applied as soon as the wounds were healed. (For further details of treatment see p. 142.) When the child begins to walk the brace shown in figure 68 should be applied. Later, when the tendency to relapse has disappeared, a weak ankle-brace, with a lock so that the toes cannot drop beyond a right angle to the leg, should be attached to a good stout shoe for a walking shoe (Fig. 74). The outer edge of the sole of the shoe should be elevated by adding an extra thickness of sole-leather gradually tapering toward the inner side, so as to throw the weight toward the inner side of the foot. It is in this variety of club-foot that the graver operations become necessary, but they are only

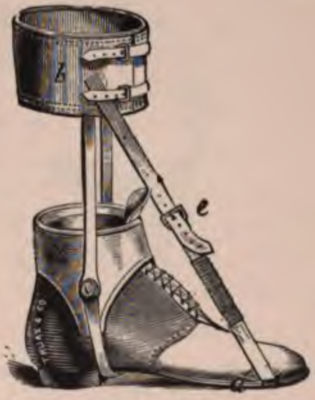

Fig. 74.—Walking shoe for equino-varus.

indicated when ordinary measures fail. It is only in old or relapsed cases that they are to be considered.

Phelps's operation consists of a free incision of all the soft parts on the inner side of the foot just in front of the malleolus (Fig. 75). It is especially applicable to cases in which the shortened soft parts on the inner side of the foot offer great resistance to reduction. Dr. Phelps uses a powerful machine of his own invention by which he applies great force to overcome the deformity after making the incision, and by this means is undoubtedly able to cure cases that would otherwise require some bone operation. He advises tenotomy of the tendo Achillis at the same sitting, but one who does not have a machine will do better to leave this tenotomy until later, since this shortened tendon holds the heel firm so that the varus can be overcome.

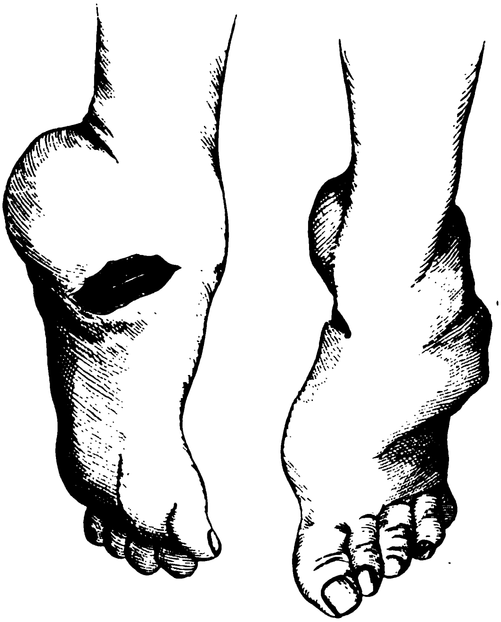

Fig. 75.—Phelps's operation (Mackenzie).

Every antiseptic precaution should be observed and an Esmarch bandage applied. The incision should begin on the inner side of the foot just in front of the inner malleolus and extend one-fourth or one-half way across the bottom of the foot. Every resisting tissue must be cut, particularly the ligaments, after which the foot must be forced into proper position. A piece of rubber tissue should be placed next to the wound, and a surgical dressing applied. Over this apply a plaster-of-Paris bandage, and hold the foot in proper position until after the plaster has hardened. The Esmarch bandage should not be removed until the dressing is complete. A blood-clot forms in the wound which is gradually replaced by new tissues through cell-proliferation from surrounding tissues. The clot does not become organized, but acts as a framework for the new tissues to form in and as a food for the new cells. This dressing is allowed to remain for one month unless the patient develops a temperature or the dressing becomes soiled. By this time the wound is usually healed. When the wound has healed the same retention shoe should be applied as is recommended for cases treated by tenotomy.

This is certainly the best operation we have for inveterate club-foot, and its application is widening as we learn to appreciate its advantages. It is really a conservative operation, since it often enables us to bring about a cure that would otherwise require a bone operation. When properly applied to judiciously selected cases, this operation is safe and satisfactory. The objection raised that the scar is sensitive has been found by the writer to be purely theoretic. An operator finding this a dangerous operation would find any operation dangerous in his hands. This valuable operation is being abused by general surgeons who are not content with orthopedic measures in any case, and in this way it is liable to be brought into disrepute. Any surgeon applying this operation indiscriminately to every case of talipes coming under his care is sure to neglect the necessary mechanical after-treatment, and will meet with many failures, for this, like every other operation for talipes, must be followed by such treatment intelligently applied in order to prevent relapse.

Removal of the astragalus is an operation highly commended by those who have practised it, but the writer has had no experience with it, preferring to remove a wedge-shaped piece from the tarsus when a bone operation is indicated. The writer has frequently removed this bone for disease, and finds that it can readily be removed through an incision along the outer side of the foot between the peronei tendons, provided it be removed in pieces.

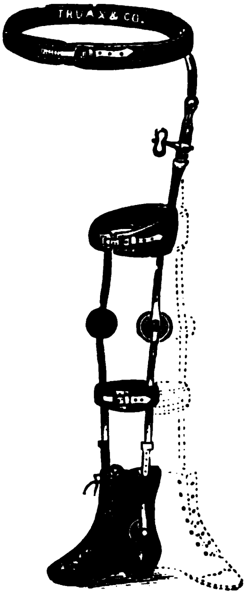

Fig. 76.—Sayre's apparatus for pigeon-toe.

Tarsal ostectomy should be resorted to when other methods fail. The writer has usually resorted to it after first performing the Phelps operation and finding decided bony deformity that would not yield, performing both operations at one sitting. An Esmarch bandage should be applied and an incision made along the outer side of the tarsus. The soft parts are separated from the bones by a periosteotome and held back by retractors, when a wedge-shaped piece may be removed from the tarsus by a bone-cutting forceps or an osteotome large enough to allow the foot to be straightened. In the hands of an able surgeon this is a safe operation, but it should never be undertaken by one who is not sure of his asepsis, for suppuration where so many bone and joint surfaces are exposed is very dangerous.

After equinovarus has been completely overcome, there is often a decided pigeon-toe, but it gradually disappears as the child grows. In milder cases the outer side of the toe of the shoe should be slightly elevated by an extra thickness of sole-leather. In marked cases, braces extending from the pelvis and attached to the shoes in such a manner as to turn the toes outward should be applied (Fig. 76).

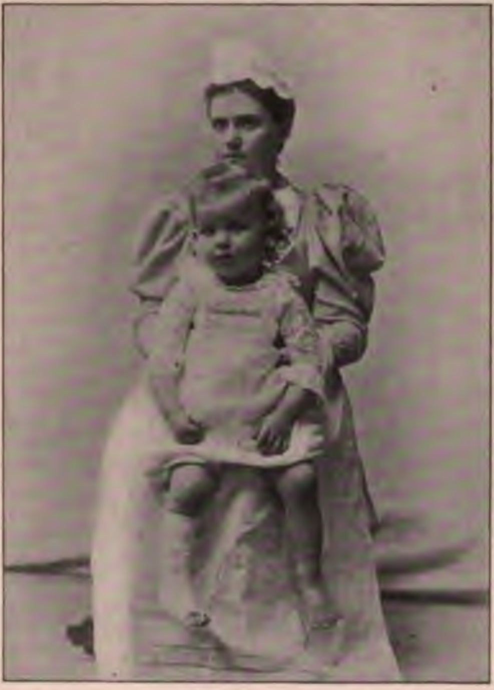

Fig. 77.—Pigeon-toe remaining after equinovarus had been overcome.

In persistent cases the tibia and femur are deformed. The writer has never seen a case in which the deformity of the femur was sufficient to demand operative interference, but has performed linear osteotomy upon the tibia, where the deformity was due to a twisting inward of that bone, with very satisfactory results (Figs. 77 and 78).

Equinovalgus requires a combination of the treatment of the two simple varieties of which it is composed.

Planus is treated in the same manner as mild valgus.

Cavus requires section of the plantar fascia followed by retention apparatus similar to that for equinovarus.

Hysteric and **non-deforming club-foot** are to be treated by removing the cause and improving the general health of the patient. It is sometimes necessary to perform tenotomy upon contracted tendons and fascia.

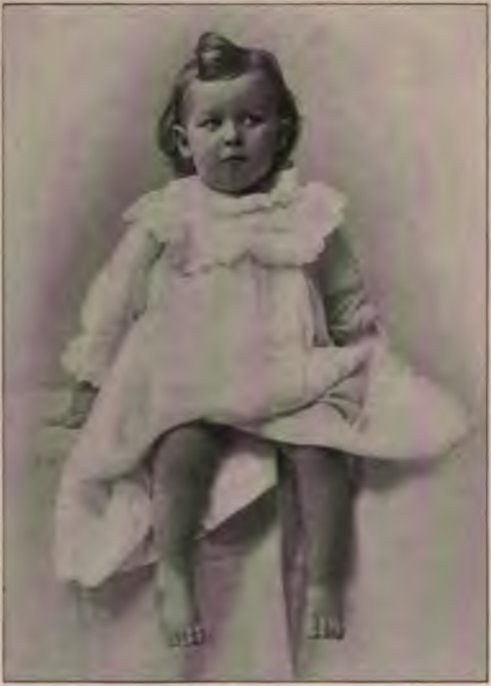

Fig. 78.—Result after linear osteotomy of the tibia, in the case represented in figure 77.

Calcaneovarus is rare, and its treatment consists of the application of general principles already laid down in the treatment of calcaneus and varus.

Calcaneovalgus requires no special treatment aside from that mentioned for the two separate varieties of which it is composed.

Weak Ankles.—The orthopedist is frequently called upon to treat weak ankles. The child walks flat-footed, with the inner malleolus unduly prominent. He is liable to fall frequently from the foot "turning under him," and easily becomes tired.

The condition is simply a lack of strength in the muscles supporting the ankle, and has a natural tendency to improve as the child grows older and stronger. It may result in flat-foot or valgus, but this is exceptional.

The treatment is electricity, massage, and comfortable support until the muscles are strong enough to properly perform their function.

In very young patients, just learning to walk, all that is advisable in the way of support is a molded leather counter, which fits about the ankle comfortably, and can be worn inside of the shoe. These "weak-ankle" braces can be bought at most of the large shoe stores.

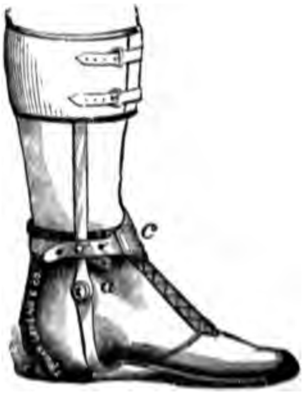

Fig. 79.—Weak-ankle brace.

For older patients the shank of the shoe should be built up with sole-leather as for flat-foot (see Fig. 69), and a simple ankle-brace worn, extending from the shoe up both sides of the leg to the knee, with joints opposite the ankle. The padding should be ample and the uprights very light, so that the child will have as little extra weight as possible to carry with its weak muscles (Fig. 79).

CHAPTER IX.

HALLUX VALGUS; BUNION; HAMMER-TOE; METATARSALGIA.

HALLUX VALGUS.

Hallux valgus is a deformity of the foot caused by a subluxation outward of the great toe (Fig. 80).

Causes.—It is said to be sometimes due to gout, rheumatism, and other joint-inflammations, but it is more likely that the deformity existed first and acted as a predisposing cause of the inflammation. The vast majority of cases are undoubtedly due to badly fitting and improperly shaped shoes. The deformity occurs most frequently in women. It is noticeable, too, that it occurs most frequently in persons who have large feet. The mere fact of the feet being large would have no causative effect, if the owners of them would wear shoes large enough for them. The narrow-toed shoes commonly worn have much to do with causing

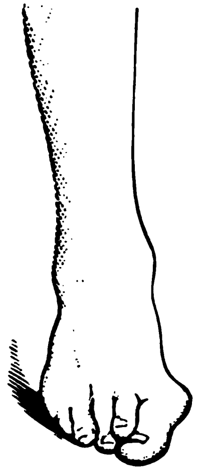

Fig. 80.—Hallux valgus.

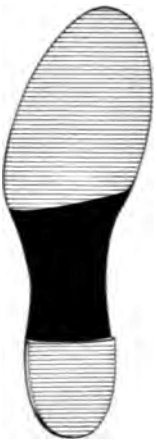

Fig. 81.—Boot of improved pattern.

this trouble. The inner side of the normal foot is almost a straight line, but very few shoes are built that way (Fig. 81).

Pathologic Anatomy.—The toe is subluxated outward, and the cartilage extends around on the outer side of the head of the metatarsal bone. The inner lateral ligament is elongated and the outer one contracted. The head of the metatarsal bone is enlarged, and a bunion forms over the inner side of it, and a corn over the bunion. The bunion consists of a bursa, which frequently communicates with the joint.

Symptoms.—The great toe is crowded over toward the center of the foot, so as to interfere with the other toes. It crowds either over or under the second toe, the former most frequently in the writer's experience. In most cases it is associated with flat-foot. The bunion and corn over the prominent joint is a source of great suffering, because it is constantly pressed upon by the shoe. The second toe is frequently the seat of very sore corns, and an ingrowing toe-nail is of common occurrence. This affliction belongs to adult life, and is usually bilateral.

Treatment.—In mild cases, if the patient can be induced to wear a suitable shoe, he will usually be relieved. Unfortunately, however, these patients usually have a weakness for wearing shoes that are too tight and too narrow at the toe, and it is very difficult to induce them to make the change. A number of mechanical devices have been employed with satisfaction in mild cases. The best one consists of a light steel spring, extending from the scaphoid along the inner side of the foot to the end of the big toe (Fig. 82). Opposite the joint, a hole is made in the spring to avoid pressure on the bunion. The proximal end of the spring is fastened to the side of the foot by adhesive strips, or a strap and buckle, and the point of the toe is drawn toward the spring by an elastic band. This device, worn for a time with a loose, comfortable shoe, will give great relief.

For severe cases an operation is advisable; without it the patient will always be a crippled sufferer, and with it an unsightly deformity is removed and suffering relieved. A number of operative measures have been advised, but only two of them are worthy of notice—viz., osteotomy of the metatarsal bone, and excision of the head of this bone. The objection to the osteotomy, whether linear or cuneiform, is that the enlargement of the head of the bone is not removed, and is bound to give trouble by being pressed upon by the shoe. Excision of the enlarged head of the tarsal bone is the operation of choice, because it is thorough and effectual. The writer has performed it many times, and always with gratifying results.

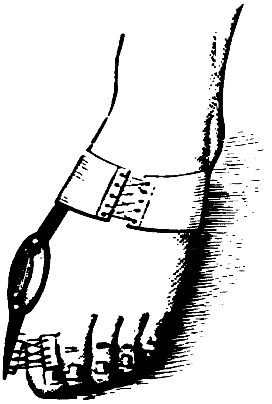
Fig. 82.—Apparatus for hallux valgus and bunion.

The foot should be thoroughly scrubbed, washed with a bichlorid solution, and an Esmarch's bandage applied from the points of the toes to just below the knee. An incision about two inches long should be made along the upper and inner side of the joint down to the bone. The whole bunion and corn should then be dissected out. The joint is opened freely, and the periosteum peeled from the head of the bone. A liberal piece of the head of the metatarsal bone should now be removed by bone-forceps or chisel, cutting from within outward, and forward, so that the cut end of the bone will slope in such a manner as to throw the point of the toe inward. Should any part of the enlargement remain, it should be chiseled off smoothly. The wound should now be closed with catgut sutures, and a surgical dressing applied. A plaster cast should now be applied and molded in between the great and second toes, so as to hold the great toe in the desired position. The Esmarch bandage should now be removed and the patient placed in bed with the foot elevated. After two or three days the patient may be allowed to sit up, with the foot on a chair. When only one foot has been operated upon, he may be allowed to get about on crutches, but when both have been operated upon he will do better to make no such effort.

The dressings should be allowed to remain for from two to four weeks unless temperature should develop. After the original dressing is removed, it is usually advisable to apply a light plaster cast, for about two weeks, that will hold the toe in the desired position.

The patient will usually be disabled for about six weeks, but the writer operated upon a professional friend who walked comfortably in three weeks.

No after-treatment is required but the wearing of properly shaped and well-fitting shoes.

HAMMER-TOE.

Hammer-toe is a deformity of the toe in which the proximal phalanx is dorsal flexed and the distal phalanx is solar flexed, bending the toe into a claw shape (Fig. 83). Both the flexor and extensor tendons are shortened, but recent dissections by Walsham and others have demonstrated that the deformity is really due to a contraction of the phalanx fibers of the lateral ligaments of the toe. Cutting of both the flexor and extensor tendons will not allow the toe to be straightened.

This condition must not be confounded with the claw-shaped toes in some cases of paralytic club-foot, in which the deformity is due to paralysis of the interossei.

Hammer-toe is said by some to be congenital and hereditary, but it is usually found in adults, and is, the writer believes, entirely due to faulty shoes. It may occur in several toes, but is usually confined to one toe—the second one. In many persons this toe is longer than the others, and is the first to feel the pressure of shoes that are too short.

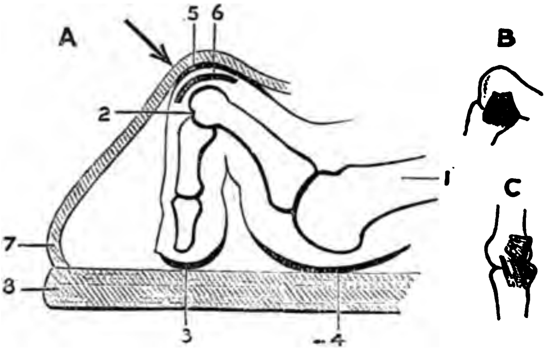

Fig. 83.—Hammer-toe. A. A diagram of the position of lines in hammer-toe: 1, metatarsal line; 2, head of the first phalanx; slight groove corresponding to position of dorsal border of second phalanx; 3, 4, 5, callosities due to boot pressure; 6, bursa over contracted joint; 7, 8, shoe (the arrow indicates the direction in which the pressure of the upper leather tends to force downward the head of the metatarsal line toward the sole). B. Dissection of first interphalangeal-joint in hammer-toe. C. The same preparation after section of plantar fibers of lateral ligaments (Anderson).

These cases are brought to the surgeon on account of the sore corns that are always present.

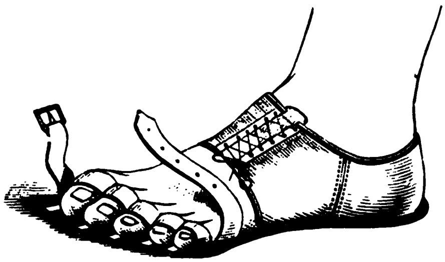

Fig. 84.—Apparatus for hammer-toe.

When several toes are involved, the lateral ligaments should be cut and the toes straightened forcibly, and afterward held straight by plaster-of-Paris for about two weeks, after which they should be strapped down to a leather sole which is to be worn inside of the shoe (Fig. 84). When only one toe is involved, the best treatment is amputation at the tarsometatarsal junction.

METATARSALGIA.

Metatarsalgia is a term applied to a painful affection of the foot described by Dr. Morton, of Philadelphia. The pain is about the head of the fourth metatarsal bone, and is believed by Morton to be due to pinching of the nerve between the fourth and fifth metatarsal bones.

Dr. Goldthwait has given the subject careful study, and has offered a rational explanation of the cause of the trouble.* He says that the pain is more frequently in the middle of the foot than at the fourth metatarsal, and that it is due to a breaking down of the transverse arch formed by the heads of the metatarsal bones. He says that the callous spot often found under the seat of pain is due to pressure from the broken-down arch.

This painful affection may begin as an acute trouble and become chronic. At times it is so severe as to disable the patient. The writer had one patient—a lady—who at times suffered so severely when walking that she was obliged to remove her shoe on the street.

The treatment that has given the greatest satisfaction, in the writer's experience, is to have the patient wear a shoe so wide that the foot is not pinched, and having a rather-heavy sole, with a low, wide heel. Under the middle of the front part of the foot, where the pain is located, is placed a light pad made of felt or several layers of roller-bandage. It should not be over an inch wide and two or three inches long, and should be placed with the long axis corresponding to the long axis of the foot.

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* "Trans. American Orthopedic Association," vol. vii, p. 82.

The relief from this treatment certainly bears out Dr. Goldthwait's theory. Some cases are so severe that excision of the head of one metatarsal bone has been performed.

CHAPTER X.

RICKETS (RACHITIS).

Rickets is a constitutional disease due to malnutrition and characterized by softening and deformity of the bones.

Dr. Jacobi said that thirty years ago rickets was a very rare disease in America.* At the present time it is not uncommon among the poor classes in every city. It is usually found in negroes and foreigners, particularly Italians and Portuguese. In England and Europe it is quite prevalent. In Italy it has been estimated that 13 per cent. of the children suffer from this disease. In 100 children examined among the poor of Boston, 40 were found rachitic.†

Causes.—A number of theories have been advanced as to the exact cause of rickets, but all are unproven. Experience has taught us, however, that anything that will interfere with the nutrition of the child may act as a cause of this disease. It is not hereditary, although cases have been reported in which the disease was congenital. It occurs, in the vast majority of cases, between the ages of six months and three years. Rickets also occurs about puberty, when it is apt to be accompanied by albuminuria.

The condition known as mollities ossium, which usually occurs during pregnancy, is probably adult rickets. It is occasionally found in old age.

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* See "Trans. American Orthopedic Association," vol. vii, p. 159.

† Bradford and Lovett, p. 617.

Sex seems to have no bearing upon the causation. The children of poor emigrants and negroes, among whom are found the majority of cases, often subsist upon a poor quality and a small quantity of food. They are crowded into small, poorly lighted and ill ventilated rooms.

When the disease occurs among Americans, it is usually among bottle-fed children. Children raised upon condensed milk or the various patent foods are very liable to develop rickets. It occurs in children who are weaned too early and fed upon starchy food. It also occurs in children who are nursed too long. Frequent pregnancies are apt to impoverish the mother's milk so that the children become rachitic. During the past three years the writer has seen several cases of scurvy in rachitic children.

Animals confined in menageries are very often subject to rickets. It is very common among young lions. Poultry also frequently suffer from it when confined.

Pathology.—The leading feature in this disease is the lack of lime salts in the bones, so that they are unduly soft. The epiphyses are enlarged and softened, and the epiphyseal cartilages are thickened and of a reddish-gray color. The growth of bone is interfered with. The medullary cavities of the long bones are enlarged. The periosteum is thickened, and underneath it is found a reddish liquid. The organic matter is increased. The skull, ribs, and wrists are most frequently affected. A characteristic symptom is a peculiar softening of the parietal and occipital bones, so that they give a peculiar crackling or parchment sensation on pressure. This condition is known as craniotabes, and may also occur in syphilis. The fontanels do not close up as early as usual, and hydrocephalus is a not infrequent complication.

The ligaments are relaxed and the muscles soft and flabby. The spleen, liver, and lymphatic glands are sometimes enlarged. The whole course of the disease resembles, in many respects, an inflammation.

Symptoms.—For convenience of study this disease may be divided into three stages—incubation, deformity, and recovery.

During the stage of incubation the child suffers from general ill health. Disturbances of digestion, accompanied by diarrhea and enlarged abdomen, are very common. Bronchitis is usually present, and bronchopneumonia is one of the causes of death. The child will be very restless at night, and throw the bed clothes off. There will be profuse night sweats. His head will frequently be covered with perspiration when other parts of the body are dry. He may be sore all over, so that he will cry out when any part of his body is touched. He will not begin to walk at the usual time, or, if he does learn to walk, he may later become unable either to stand or walk—not because he is paralyzed, but because his bones and muscles are so sore. His fontanels will remain open longer than usual, and his teeth will be slow in coming. He becomes pale and delicate looking. The urine is overabundant and loaded with phosphates.

The stage of deformity comes on quite early and is very characteristic. The forehead is unusually high and square, owing to the prominence of the frontal eminences (Fig. 85). The fontanels and sutures are often longer than usual. The veins of the scalp are enlarged, and, in many cases, a true hydrocephalus develops which does not differ from other cases of hydrocephalus. With the latter symptom convulsions may be present. Hyperemia of the brain and meninges is common. The teeth appear late, and sometimes assume the peculiar notched appearance so often seen in syphilis. The lower jaw is small and rectangular.

The thorax becomes flattened from side to side, and the sternum projects forward, making the so-called "pigeon breast." This deformity may be so marked that the transverse diameter of the chest is shorter than the anteroposterior diameter. The lower ribs may be pushed upward by the enlarged abdomen so as to cause what is known as "Harrison's groove." The costal end of the ribs may become enlarged so that a row of protuberances can be felt just at the junction of the ribs with the costal cartilages on either side. This condition is spoken of as "beaded ribs." The ribs may project forward on one side. The spine may become bent forward (Fig. 86). The bend usually involves the whole length of the spine, and can be made to disappear by proper position (Fig. 87). Scoliosis occasionally develops. The pelvis is very liable to become deformed, so that it is very important that every young woman who has suf-

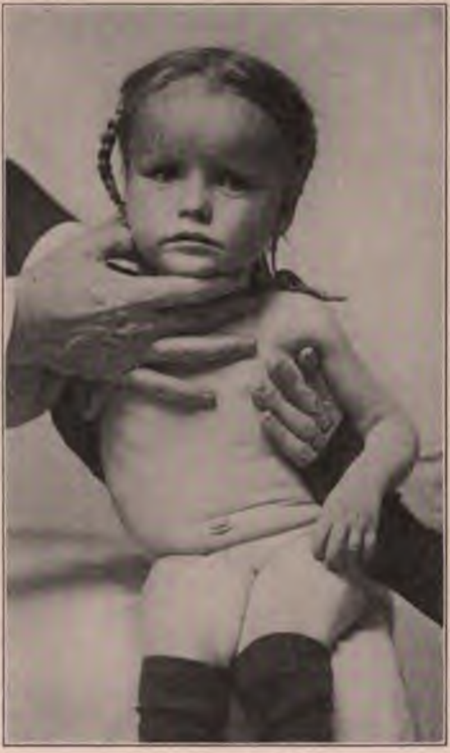


Fig. 85.—Rachitic head.

fered from rickets in childhood should not marry without first having had her pelvis examined by a competent physician. The extremities may become deformed from muscular action before the child walks or creeps. Later, the bearing of the weight of the body will increase this deformity.

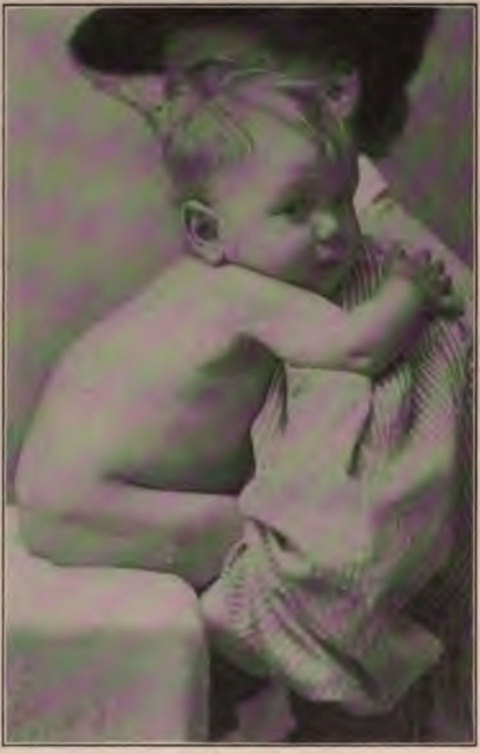


Fig. 86.—Rachitic spine.

The epiphyses of all the long bones become enlarged, and the bones may easily be bent (Fig. 88). Flat-foot is almost invariably present, and bow-legs or knock-knees are among the most common deformities. The attitude of a rachitic child is quite characteristic. He will stand with his feet wide apart, his knees slightly flexed, his lower spine lordosed, his elbows flexed and projecting from his side, and his head and shoulders thrown forward. These symptoms are not all present in every case. The deformities quite uniformly found are flat feet, enlarged epiphyses, bow-legs or knock-knees, and the deformities of the head.

During the stage of recovery the bones become hardened, so that they are harder than healthy bones. Most of the deformities remain throughout life unless relieved by treatment. It is undoubtedly true that some cases do improve in time, but it is not safe to promise that the child will outgrow it. The growth of bone is interfered with so that the person is apt to be dwarfed, but they sometimes develop great strength and live out their expectancy.

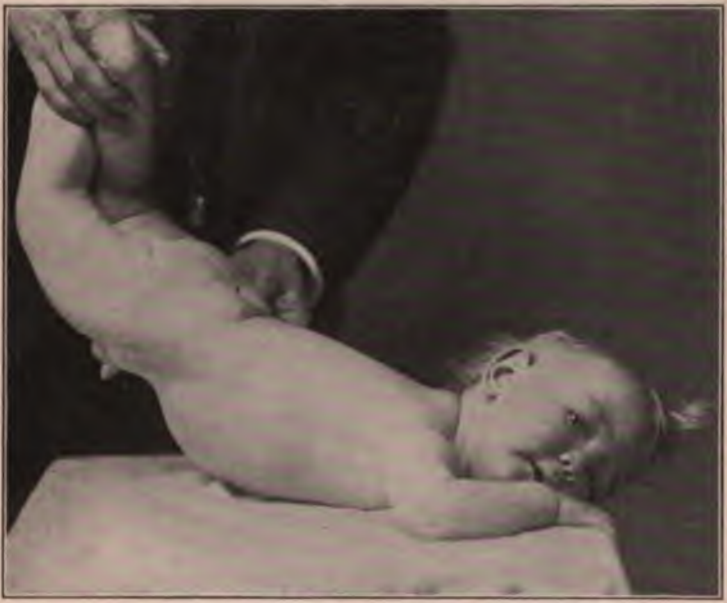


Fig. 87.—Rachitic spine straightened by position.

Diagnosis.—In the early stages this disease is frequently mistaken for other diseases. It is sometimes impossible to make the diagnosis before deformity appears. It is apt to be mistaken for chronic diarrhea, bronchitis, or rheumatism. The differential diagnosis between chronic diarrhea and rachitis before deformity occurs is practically impossible, because in both cases the child is pale and flabby and learns to walk late. In all such cases enlargement of the epiphyses should be watched for, and special attention paid to the diet.

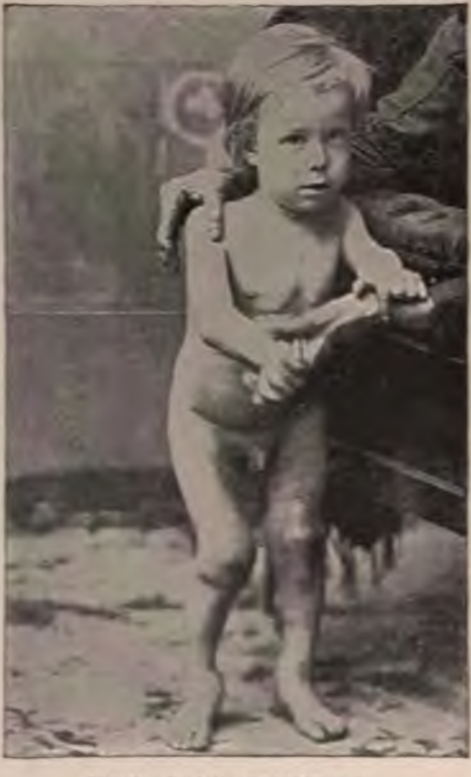


Fig. 88.—Rachitic child (Gillette).

Rachitis and infantile syphilis bear a strong resemblance to each other. In syphilis, bending of the bones is not a common symptom, and, when it does occur, it is sharp and angular, resembling a fracture. When enlargement takes place in syphilis it is not restricted to the epiphysis but extends to the shaft as well. Deformed teeth and craniotabes occur in both diseases. These differential points, together with the characteristic symptoms of the disease present, should enable a careful observer to make the diagnosis.

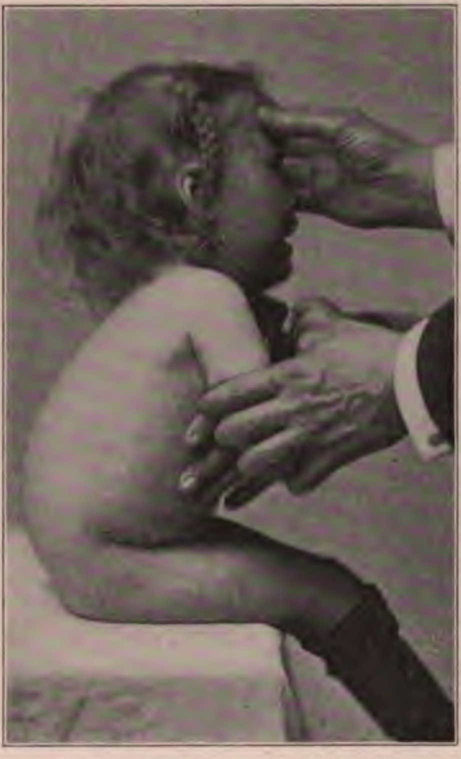


Fig. 89.—Complete curve of rachitic spine.

Rheumatism is not so common as rickets in children, and when it does occur, can be diagnosticated by the high temperature and swelling of the joints.

Bronchitis, due to rickets, can only be positively diagnosticated where some of the other symptoms of rickets are present. The head-sweats, open fontanels, and delayed development should lead one to suspect rickets.

The deformity of Pott's disease sometimes resembles that of rickets. Ordinarily, the kyphosis of rickets is a long even curve, which disappears when the child lies on its abdomen (Fig. 87), but exceptionally the rachitic kyphosis is sharper than usual, and as rigid as kyphosis from Pott's disease. In such a case, a positive diagnosis of rickets could not be made unless there were other symptoms of this disease. Even then it should be remembered that a rachitic child may develop Pott's disease.

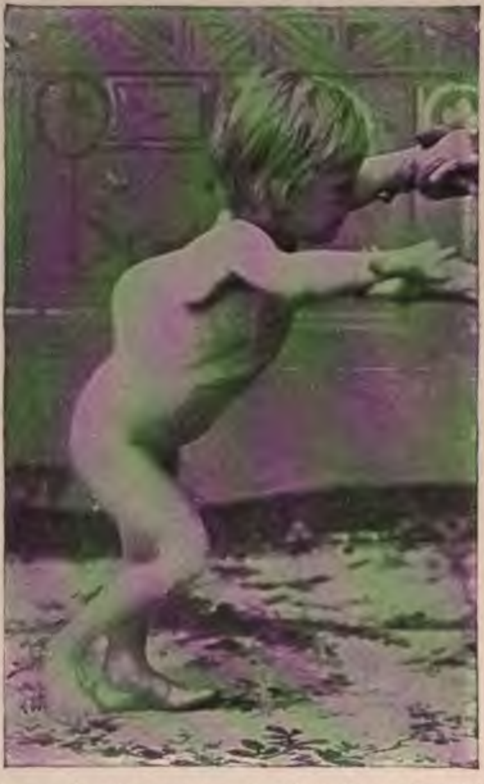


Fig. 90.—Rachitic spine resembling Pott's Disease (Gillette).

Sir James Paget describes a disease occurring in aged persons that he named osteitis deformans, and which resembles adult rickets (Fig. 91). It is an osteitis accompanied by a softening and bending of the long bones and a curving forward and stiffening of the spine. The skull is enlarged and thickened. This disease is not so much in the epiphyses as in the diaphyses, and lacks all the other symptoms of rickets.

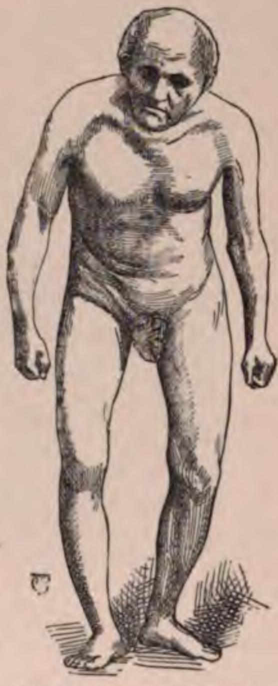


Fig. 91.—Osteitis deformans (Lunn).

In a well-marked case of rickets, where the child gives a history of late teething, late walking, disturbed digestion, and bronchitis, when its head has the peculiar shape, and the fontanels are open at a late date, and when the characteristic bony deformities exist, the diagnosis is very easily made. It should be remembered that a child who has no teeth when he is nine months old probably has rickets.

Prognosis. — Under proper treatment the prognosis in rickets is good. The majority recover, but with some deformity. The dangerous symptoms and complications are diarrhea, bronchitis, pneumonia, and hydrocephalus. Recovery, aside from the deformity, is apt to be complete. Bow-legs and knock-knees, which are usually due to rickets, can be cured by proper treatment, and will be discussed separately.

Treatment.—The treatment of rickets is prophylactic, medical, mechanical, and operative. The prophylactic treatment consists in giving the child proper nourishment and plenty of light, air, and exercise. One of the most pernicious fads of the day is that it is not the proper thing for the mother to nurse her child. A woman who cannot or will not nurse her child should not bear children. The physician who, upon every flimsy pretext, advises the mother not to nurse her babe, is betraying the trust reposed in him. The subject of infant feeding is too large a one to discuss here, but in brief it can be said that the nearer the food approaches nature's food the better, and nature's infant food contains no starch and comparatively little sugar.

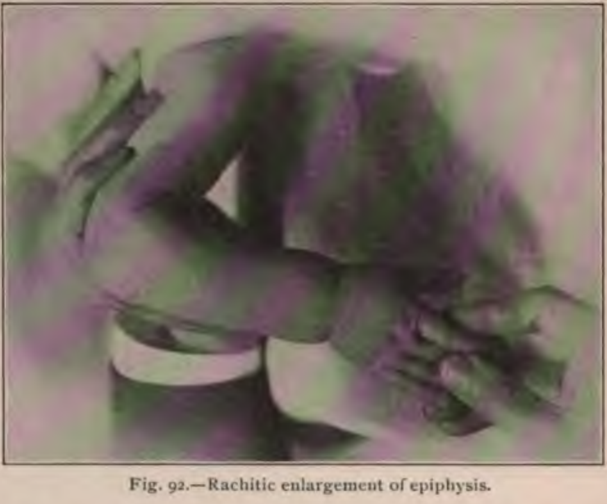


Fig. 92.—Rachitic enlargement of epiphysis.

The medical treatment is of much greater value in this than in most of the diseases coming under the orthopedist's care. Since one marked feature of the disease is the lack of lime salts in the bones, we naturally give lime. Lime-water seems to have comparatively little effect upon the disease save as it benefits the stomach and bowels. Probably the best preparation is the lactophosphate of lime, soda, and potassa. Phosphorus is extensively used abroad, but the writer has derived no benefit from it. It is best given in solution in oil, in doses of $\frac{1}{100}$ of a grain. Cod-liver oil is a favorite remedy with many, and when it agrees with the stomach does good service, but the good it does is as a food rather than as a medicine. The syrup of the iodid of iron, given three times a day, in doses of one drop for each year of the child's age, is a valuable remedy. It should be kept in a cool, dark place. The writer depends most upon the last-named remedy, the lime preparation previously mentioned, the preparations of maltine, and good milk.

The mechanical and operative treatment employed to overcome the various deformities of the spine and extremities will be discussed under their various headings.

CHAPTER XI.

BOW-LEGS.

This deformity consists of a bowing outward of the lower extremity (Fig. 93). Both the femur and tibia are usually involved, but the tibia is usually much more deformed than the femur. As a rule, it is double, but occasionally only one extremity is involved.

Rarely, bow-leg occurs on one side and knock-knee on the other. It comes on in early childhood, and is due to rickets. The deformity may begin before the child has borne its weight upon the legs, in which case it is due to the action of muscles upon the bones softened by disease. Early walking does not cause bow-legs. As a rule, bow-legged children learn to walk late. When they do begin to walk with softened bones, the weight of the body will naturally cause bending. The deformity may be largely due to a bending outward of the knee.

The pathology of bow-legs is that of rachitis.

If the legs of a child suffering from the deformity be brought together, so that the inner malleoli touch, the knees will not touch, as they do in a well-formed child, but will be separated more or less according to the amount of the deformity.

The greater part of the deformity will usually be found at the junction of the lower with the middle third of the tibia. The child is flat-footed, and walks with a peculiar wabbling gait. He tires easily and, if old enough, complains of pain.

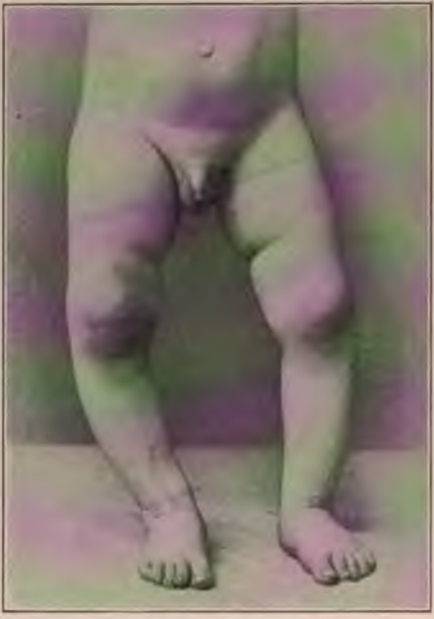


Fig. 93.—Bow-legs.

Other symptoms of rickets are usually found, such as enlargement of the epiphyses and deformities of other bones. The presence of the deformity is sufficient to establish the diagnosis.

Under proper treatment, the prognosis is favorable. The treatment may be expectant, mechanical, or operative.

The expectant treatment consists of treating the rickets and so manipulating the limbs with the hands as to coax them into shape, as it were. The nurse can be instructed to grasp the limb firmly in the hands and unbend it several times a day. After the active stage of the rachitis is past, this can be done without discomfort to the child. Massage and sea-salt baths are valuable adjuncts to this treatment.

By following this course faithfully, a certain number of these cases can be cured. It is, of course, only at an early age, while the bones are still soft, that this treatment can be expected to prove efficient.

There is a natural tendency under favorable circumstances for these cases to improve, but it is never safe to tell the parents that the child will outgrow it. The expectant plan is only to be recommended in very mild cases, or where the parents will not allow braces to be used. In severer cases or in older patients, either mechanical or operative treatment is to be recommended. The surgeon who makes a judicious selection of the method of treatment for each case is always safe in giving a favorable prognosis, but the one who treats all cases alike is bound to meet with some failures. While the child is under four years of age, or so long as the deformity can be partly overcome by grasping the legs and unbending them, the surgeon can choose the method which he deems the best or most convenient for that particular case. After the bones have hardened, as they usually do by the end of the fourth year, operative measures should always be resorted to, because mechanical measures will fail.

It is the writer's custom to say to the parents of a bow-legged child whose bones are soft enough to yield to mechanical pressure, that there are two ways of straightening the limbs: one by means of braces, and the other by operative measures. The former is safe and sure, but very slow, requiring usually from one to two years. The latter is equally safe and sure, and requires but from four to six weeks. After having laid the whole matter before them, the parents are requested to make a choice of the method.

In favor of the braces it can be said that no anesthetic is required for their application, that after a very few days they will add to the patient's comfort by their support, and that there is nothing in the way of an operation connected with them. Against the braces it can be said that they require considerable attention for a long time, and unless properly applied may fail, and that they are unsightly and more or less burdensome.

In favor of operative measures it can be said that the time spent from the beginning of the treatment until the child is walking upon straight legs is but a few weeks; that the suffering is very slight, indeed,—hardly more than that caused during the first few days by braces, and that all of the trouble, annoyance, and wounded pride caused by braces are avoided.

When the choice is left to the writer, he advises the quick method, except in the few cases in which the bones are so soft that relapse is to be feared. This method is chosen because, after a varied experience with both methods, it has been found most satisfactory. It yields prompt and satisfactory results, and the surgeon sees the cure completed. The great objection to braces from a surgeon's standpoint is that parents are very prone to grow careless and fail to bring the child to him for readjustment of the braces. They are apt to think that when the braces are once applied there is no further need of a surgeon's care, and the result is liable to be that after a time the braces do not fit properly and fail to straighten the limbs before the bones become too hard, so that it becomes necessary to resort to operative measures after all.

The best mechanical means of treating bow-legs consists of steel uprights extending from the shoes up on both sides of the legs as far as necessary, with joints at the knee and ankle (see Fig. 94). Our efforts are usually directed entirely toward the deformed tibia, because the deformity of the femur is not so noticeable and is not so easily reached. Usually it will be sufficient to extend the brace from two and one-half to four inches above the knee, according to the age of the child. The steel uprights do not need to be heavy, because we cannot expect to force the bones into shape, but we must keep up a gentle pull in such a direction as will induce them to grow straight, just as we would make a twig grow into almost any shape by gently and persistently pulling it in the desired direction. Only such pressure can be made as will be borne by a child's delicate skin without chafing. Cuts of this apparatus, with directions for measuring, can be found in any instrument catalogue. A pad must be placed over the inner malleolus and over the inner condyle of the femur, because it is upon these points that the pressure is brought to bear. A pin is placed in the inner upright just opposite the greatest curvature of the tibia, upon which are buttoned both ends of a strap which passes around the limb at this point. This strap passes between the leg and the outer upright. It is perforated by a number of buttonholes at each end, and the amount of pressure is regulated by them. When it is tightened it makes direct pressure upon the convexity of the deformity, and the counterpressure comes upon the pads at the knee and ankle. As the limb grows straighter the strap must be tightened, until the inner upright finally touches the whole length of the leg.

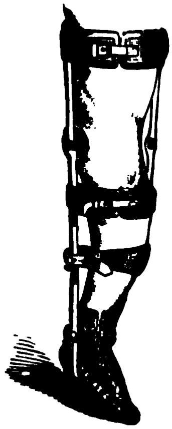


Fig. 94.—Bow-leg braces.

In a case where the bones are so soft that the deformity disappears in a few weeks it will be necessary to have the child wear the braces for a long time, until the bones have hardened, otherwise relapse is sure to follow. In such a case it is needless to say that operative measures would fail unless followed by mechanical treatment to prevent relapse. In cases where the thighs are decidedly bowed, or the tibiæ twisted on their long axes, the braces must extend to a pelvic band which grasps the pelvis between the great trochanter and the crest of the ilium.

In a case where the child has practically recovered from rickets and the bones have hardened in the deformed position, operative measures should be resorted to, because any pressure that could be borne by the skin would not be likely to have the desired effect. The rule is, that after the fourth year operation is indicated and braces are contraindicated, for even in the cases that could be benefited by braces after this age, the time required would be entirely too long. It is unkind to compel a child who is old enough to mingle with other children to wear braces for months and years, and put up with the gibes and jeers of the others, when he could be relieved of his deformity in a few weeks by a safe and satisfactory operation.

When an operation is decided upon, the surgeon has the choice between two operations, both of which have enthusiastic advocates—viz., osteotomy and osteoclasis.

Osteotomy, which consists of breaking the bone with a chisel or osteotome through an open wound, is the choice of most general surgeons, and with modern methods it is a very safe and satisfactory operation. It is not absolutely free from danger, however, because some deaths have occurred in very competent hands. Suppuration followed one of the writer's operations, and the final result was non-union, which required a second operation, resulting in some shortening of the limb. The operation is performed as follows: After thoroughly cleaning the limb, an Esmarch bandage is applied and an incision made over the flat surface of the tibia at the point of greatest deformity. The osteotome (Fig. 95) is then introduced and its cutting edge placed at a right angle to the long axis of the bone, when by a few light strokes of a mallet the instrument is driven into the bone. By a scale on the side of the osteotome an exact measurement of the depth to which it has been driven is made. It is not necessary to cut through the bone, for after cutting two-thirds of the way through it can be easily broken. The instrument should not be used as a lever to break the bone, but the surgeon's hands should grasp the limb and complete the work. It is rarely necessary in a child to cut the fibula, since it can be broken readily with the hands; but if it is necessary, as is possible in an adult, it should be done through a separate opening over the convexity. The wound is now closed by catgut sutures, and a surgical dressing and a plaster bandage applied with the limb in

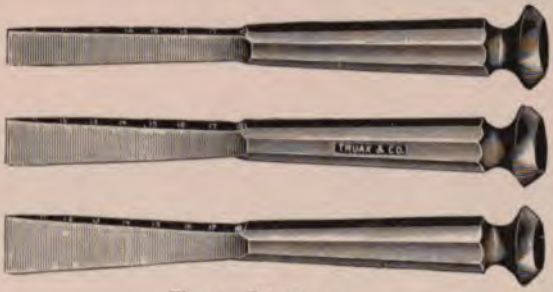


Fig. 95.—Osteotome.

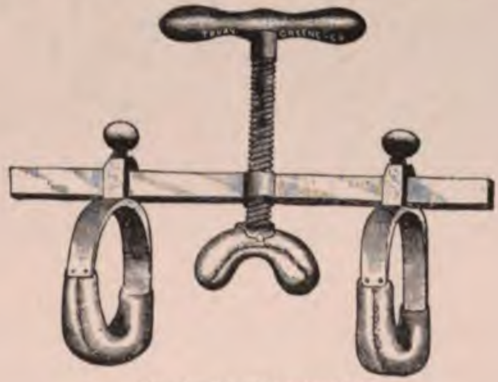
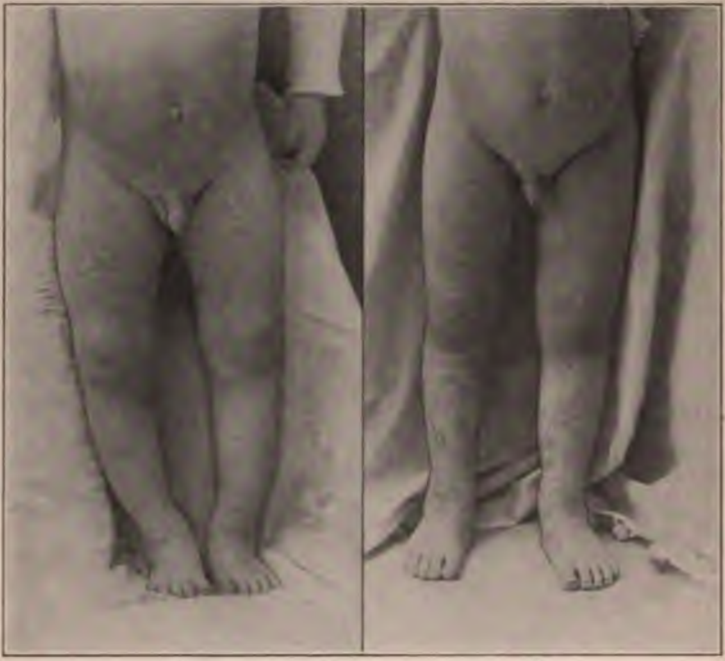


Fig. 96.—Rizzoli's osteoclast.

the corrected position, after which the Esmarch bandage is removed. This dressing should remain for a month, unless there is an undue rise of temperature. If the thermometer registers 102° or over, the dressing should be changed. It is never necessary in a case of bow-legs to remove a wedge-shaped piece of bone, for nature fills in the gap between the ends of the bone when they do not exactly fit.



A B

Fig. 97.—A, bow-legs; B, result after osteoclasis.

Osteoclasis consists of breaking a bone by means of an instrument called an osteoclast (Fig. 96). The accompanying cut represents Rizzoli's osteoclast, which has proven entirely satisfactory in the writer's hands.

This operation is perfectly safe and very satisfactory. Fracture invariably occurs exactly opposite the screw, and with ordinary care abrasions of the skin do not occur.

Objections raised to this operation are theoretic, and are not made by those who have had actual experience with it. In the hands of inexperienced operators, osteoclasis is certainly the operation of choice, because an accurate surgical technic is not required. The rings should be so placed that they will come in contact with the two extremities of the bone to be broken. The screw pad is placed over the convexity at the seat of the greatest deformity. The instrument is now held steady by an assistant and the screw is run down rapidly. The bone will yield with a loud snap, but usually not until after it has been very much bent. In children, a green-stick fracture usually occurs, which will unite in the shortest possible time. A light dressing of sterilized gauze or cotton is now applied, and a plaster cast over this, extending from the body over the foot. After four or five days the child can be allowed to play upon the bed or on the floor, and will be perfectly comfortable. It is advisable to put the legs up in a slightly overcorrected position. This dressing need not be changed for a month, when firm union will have taken place (Fig. 97).

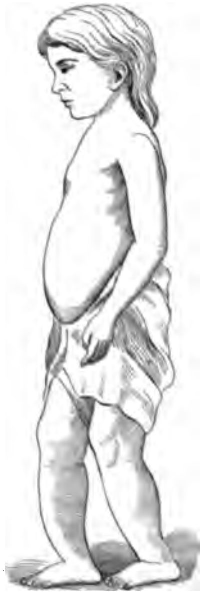


Fig. 98.—Anterior rachitic curve (Gillette).

The writer cannot recommend this operation too highly, because it invariably yields prompt and satisfactory results, and never in a single instance has any unpleasant complication occurred in his hands.

In some cases of rickets an anterior curvature of the tibia occurs (Fig. 98). In these cases osteoclasis is not so good an operation as osteotomy, because the sharp crest of the tibia is liable to cut through the skin; and when this occurs, it is better that it should be a clean knife cut than a lacerated wound. In extreme cases of this kind, it may be necessary to remove a wedge-shaped piece of bone (Fig. 99).

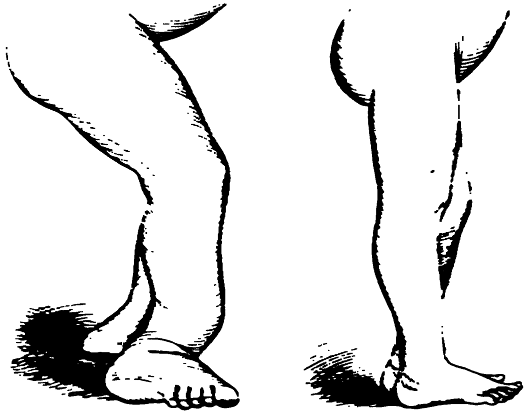


Fig. 99.—A, rachitic deformity; B, after osteotomy (Willard).

CHAPTER XII.

KNOCK-KNEE (GENU VALGUM).

KNOCK-KNEE is a deformity characterized by a projecting inward of the knee (Fig. 100). If the knees be brought together and the limbs extended, the malleoli will be separated more or less, according to the degree of the deformity, instead of touching, as they do in a normally developed person. When the knees are flexed, the deformity disappears.

In severe cases there is marked lateral motion at the knee-joint owing to the lengthening of the internal lateral ligaments (Fig. 101).

This deformity occurs only about half as often as bow-legs, and is more common among boys than girls. It may be either single or double. It occurs most frequently in children between two and four years of age, when it is due to rickets. It sometimes occurs between the ages of twelve and eighteen, and in older adults. In young adults, it may be due to general weakness and poorly constructed joints, but in older adults it is the result of occupation. Bakers, waiters, and others who are obliged to be upon their feet much, or with the feet wide apart, are subject to knock-knee. Flat-foot accompanies this deformity, and may at times stand in a causative relation to it. Children suffering from a slight knock-knee will very frequently walk pigeon-toed. The writer has found that in the majority of cases brought to him for pigeon-toe the deformity was due to a

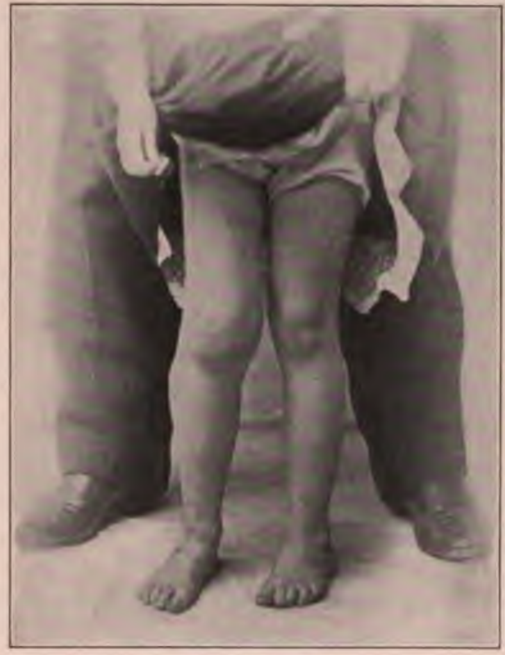


Fig. 100.—Mild knock-knee.

mild knock-knee, and that when the knock-knee was remedied the pigeon-toe disappeared. At various times it has been taught that the deformity in knock-knee is due to ligamentous or muscular changes. While it is true that in severe cases the internal lateral ligaments are elongated, it is evident that this change is a result, rather than a cause, of the deformity. The external lateral ligaments are short only by comparison, since no real shortening has taken place.

Until recently it was believed that the deformity was due to hypertrophy of the inner condyle of the femur. While the inner condyle is frequently enlarged, it has been satisfactorily demonstrated that the deformity is mostly due to the epiphysis being attached obliquely to the diaphysis.

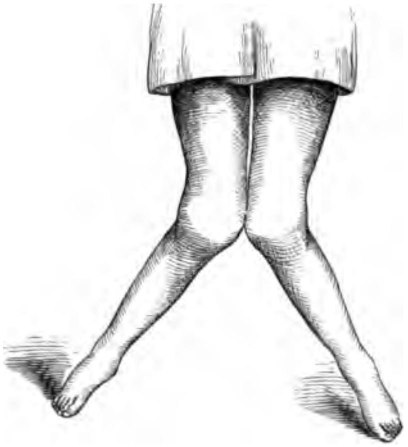


Fig. 101.—Extreme knock-knee.

Knock-knee may be a sequel of a chronic joint-disease.

The peculiarity of the gait which accompanies this deformity is due to the fact that the patient is obliged to swing his foot away from the median line in order to make the knees swing clear of each other.

The prognosis, under proper treatment, is good. The most unfavorable symptom is excessive lateral motion at the knee-joint. Cases coming on in adult life are rarely severe.

The treatment of knock-knee may be expectant, mechanical, or operative. Expectant treatment is not to be recommended unless, for some special reason, no other can be applied, because the tendency is for the deformity to grow progressively worse, until the patient becomes about twenty years old. When, for any reason, other treatment cannot be applied, the limb should be grasped by the hands of the nurse or parents, and an effort made, several times a day, to overcome the deformity.

The child will become tired easily, and will complain of pain and soreness. He should not be urged to be upon his feet too much, and when he shows a disposition to rest he should be allowed to do so.

The proper mechanical treatment consists of outside steel uprights, extending from the sole of the shoe to the crest of the ilium, with joints at the hip, knee, and ankle (Fig. 102). At the upper end of the uprights is a steel waist-band to hold the brace in place. A pad is placed over the inner side of the knee, and fastened by straps to pins on the outer side of the upright. The amount of pressure is regulated by these straps. It never need be heavy, for the deformity is not to be forcibly overcome, but is to be gently pulled in the right direction until the limb grows straight. In charity cases, where the parents are unable to furnish apparatus, knock-knee can be successfully treated by the application of a plaster cast extending from the ankle to the hip, the knee being put in the best possible position at each application.

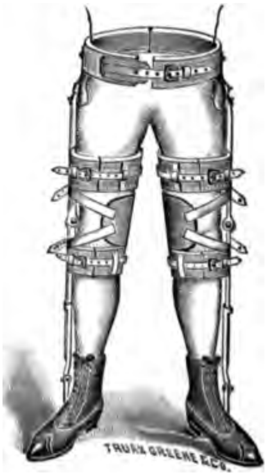

FRANK GREENE & CO.

Fig. 102.—Knock-knee braces.

In children under four years of age, and in older children whose bones are still soft, mechanical treatment will always yield satisfactory results in a year or two, and should always be the treatment of choice. In patients whose bones cannot be bent with the hands, operative measures should always be resorted to. As a rule, patients over four years of age will require an operation. It is a mistake to apply braces when the bones are so hard that they cannot be molded by gentle, steady pressure.

Osteoclasis has been employed for knock-knee, but it is not to be recommended, because it is neither so safe nor so satisfactory as osteotomy owing to the proximity of the joint.

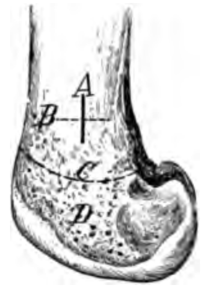


Fig. 103.—Macewen's operation for genu valgum: *A*, skin incision; *B*, osteotome incision; *D*, inner condyle.

A number of operations have been devised, but what is known as Macewen's osteotomy is now universally employed. This consists of a linear osteotomy just above the epiphyseal line of the femur. Macewen advised that the osteotome be entered from the inner side of the thigh, but many operators prefer the outer side. It really makes no difference, for with the knee flexed the femoral artery is out of the way (Fig. 103).

After properly cleansing the limb, an Esmarch bandage is applied, and the limb laid upon a sand-bag with the knee flexed. The writer usually operates from the outer side, because it is farther from the femoral vessels. A longitudinal incision about an inch long is made just far enough above the condyles to avoid the epiphyseal line, and directly over the center of the shaft of the femur. The incision should extend down to the periosteum, and before the knife is removed the osteotome should be introduced alongside of it until it touches the bone. The knife is then removed and the osteotome turned with its cutting edge at a right angle to the bone. By firm, steady strokes of a mallet the instrument is driven into the bone. When it enters the medullary canal the resistance will be less until it reaches bone on the far side. After reaching the medulla, it is well to loosen the chisel by moving it from side to side, and start it again a little farther forward or backward, as required, and thus lengthen the cut in the bone. When the operator feels or sees that he has cut about three-fourths of the way through the bone, he should grasp the limb in his hands and break the bone. The osteotome must not be used as a lever to break the bone, as the instrument is very liable to break.

Great care should be exercised lest the chisel be driven entirely through the bone and injure anatomic structures on the farther side.

When the bone is broken, the deformity should be overcome and the limb placed in a straight position. A surgical dressing and a plaster bandage from the foot to the body are now applied, and the Esmarch bandage removed. Unless an abnormal temperature develops, this dressing should remain four or five weeks, when firm union will have taken place and the child will have a straight limb.

CHAPTER XIII.

BENDING OF THE NECK OF THE FEMUR, OR COXA VARA.

This deformity is a bending of the neck of the femur, allowing the trochanter to rise above Nélaton's line, and probably exists more frequently than we are aware of, for it was never carefully described until 1889, when Miller's article appeared in Germany (Fig. 104). Dr. Royal Whitman, of New York, read a valuable article upon the subject before the American Orthopedic Association in 1894.*

The deformity appears between the thirteenth and eighteenth years. There is no pathologic condition aside from the bending of the bone. The joint is perfectly healthy. Whitman classifies it with acquired knock-knee and bow-legs, and does not believe that rickets can be considered the one cause, because other rachitic symptoms were absent in his cases. He has examined a large number of rachitic children, and when he found the trochanter projecting above Nélaton's line it was due to the bowing outward of the shaft of the femur.

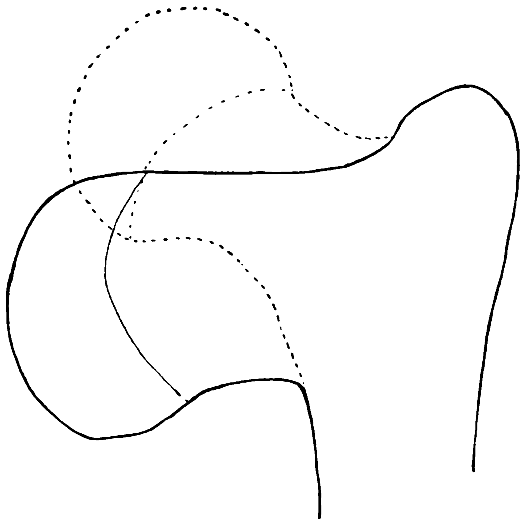


Fig. 104.—Outline of the depressed neck of the femur in Miller's specimen, contrasted with the normal position shown by the dotted line (Whitman).

Most writers, however, believe that this is a rachitic deformity. Leusser, in the *Presse Medicale*, of October 5, 1895, says that in most cases observed by him other rachitic symptoms were present. It occurs usually in persons whose occupation compels them to stand constantly, or in those who carry heavy burdens (Fig. 105).

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* See "Transactions," vol. vii, p. 270.

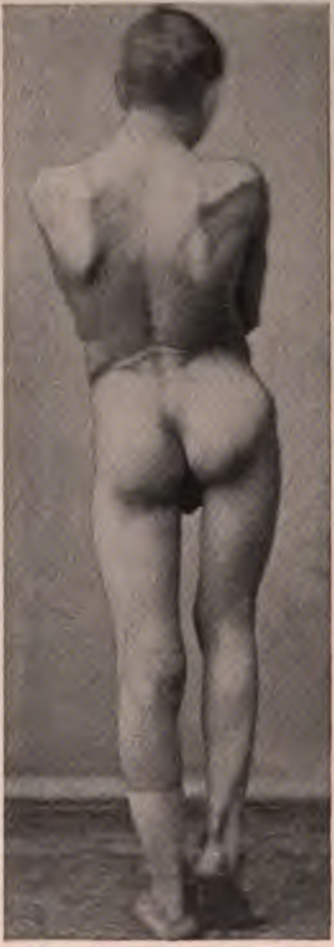

Fig. 105.—Bending of neck of femur. Shows the apparent shortening of the right leg, the prominence of the trochanter, the adduction, and compensatory tilting of the pelvis (Whitman).

The writer's experience is limited to one case, which developed in a young woman during pregnancy. The symptoms are a limp, coming on without apparent cause, in a young adult. The patient tires more readily than formerly, but complains of comparatively little pain. There is no swelling or tenderness on pressure. Actual shortening soon appears. The tip of the great trochanter gradually rises above Nélaton's line until the joint assumes the appearance of a dislocation or fracture of the neck. There is slight rotation outward and adduction. Moderate atrophy is present. Most of the cases reported have been unilateral. Joint motion is free in every direction, the limp being due to the shortening and adduction.

The **diagnosis** is comparatively simple when the deformity is once fully developed, as it usually is when the case comes to the orthopedist, for it is the disability and not the pain that brings the patient to him. It is to be differentiated from congenital dislocation of the hip, morbus coxarius, and osteitis deformans. The history is sufficient to differentiate between congenital dislocation and this acquired deformity. In hip-joint disease there is pain, soreness, and restriction of motion, which are absent in coxa vara. Osteitis deformans comes on later in life.

The **prognosis** is good as to life, but the tendency is for the bending to increase until there is at least an inch real and three or four inches apparent shortening.

The **treatment** consists of changing the occupation and building the patient up if he is weak or run down. Massage and proper gymnastics are recommended. A long hip splint has been used with satisfaction, and is certainly a rational means of treatment. Later, when the bending has reached the limit and the bone is hardened, an osteotomy of the femur just below the trochanters should be performed.

CHAPTER XIV.

DEFORMITIES OF THE HAND.

Club-hand is a rare deformity, analogous to club-foot, and usually accompanies deformity of other parts. The deformity is usually a flexion at the wrist, but it may be displaced toward the dorsum, the radial, or the ulnar side. The radius is sometimes entirely wanting, and quite frequently only partly developed. The carpus is usually incompletely developed (Figs. 106 and 107).

The causes are not known. A number of the theories applied to club-foot can also be applied to club-hand, but none can be proven.

The prognosis in mild cases is fairly good, but in severe cases it is bad, because of the lack of bone development.

The treatment in mild cases consists of placing the hand in proper position, and holding it there until the bones have developed.

Of the three cases coming under the writer's care, two have been cases of flexion with lack of development of the radius and carpal bones, and in one of these the thumbs were absent.

The treatment was to gradually straighten the hand by repeated applications of plaster casts, holding it in the normal position until the radius developed. In one case the bones developed quite rapidly, and the result was very satisfactory.

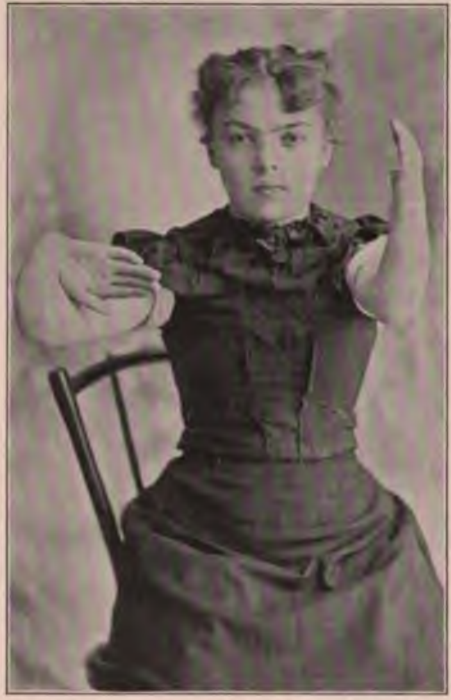

Fig. 106.—Double club-hand, showing right hand before and left hand after operation (Thompson).

In the third case, there was double equinovarus with double club-hand. The patient came from a long distance, and was obliged to go home after the feet were straightened without having had the hands treated. The child was young and very delicate, and it was not deemed advisable to treat the hands until after the feet had been treated.

Tenotomy is not so satisfactory here as in club-foot, because the tendons will sometimes fail to unite. When it is absolutely necessary to cut a tendon, it is better to splice it through an open wound.

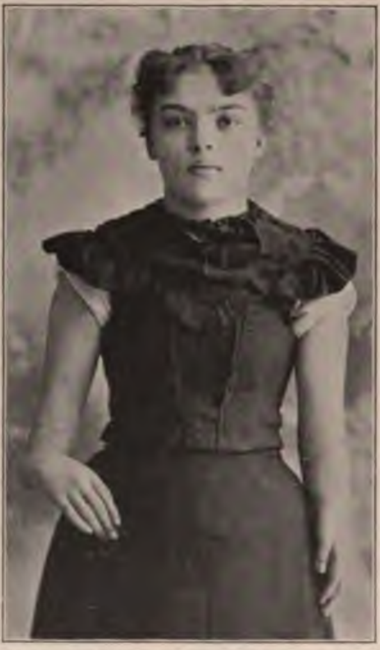

Fig. 107.—Double club-hand, showing right hand before and left hand after operation (Thompson).

Dr. Reginald Sayre reports a case * in which there was lack of development of the radius and carpal bones and a crooked ulna. He first performed an osteotomy upon the ulna and straightened it, and then shortened the ulna,

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* "Transactions American Orthopedic Association," vol. vi.

removed a portion of the poorly-developed carpus, and made the ulna articulate with the remaining carpus. The result was quite satisfactory.

Dr. S. S. McCurdy reports a case * in which he sawed off a portion of the ulna and made the shortened bone articulate with the semilunar.

Bardenheuer suggested and practised an operation which yielded very satisfactory cosmetic and functional results. He split the ulna longitudinally and crowded the carpus between the two parts of the split bone, fastening it there with a nail on either side.

Supernumerary fingers, or **polydactylism,** is a condition which occurs quite frequently, and is very commonly hereditary. The writer knows of one family in which there are several children who all have six fingers on each hand, and whose father and grandfather also have six fingers. The fingers are well-developed and useful. In many instances, however, the fingers are poorly developed and unsightly. Both hands are usually affected.

When the digits are well-developed, no treatment is indicated, but when poorly developed they should be amputated. When a child is born with such a deformity and the attachment of the supernumerary finger is very slender, as is often the case, it would be proper and right to cut it off at once with the scissors, and apply a bandage to prevent the loss of blood. In this way the mother would be saved the annoyance of neighborly comments.

Webbed fingers are a not uncommon deformity. Only two of the fingers may be grown together, or all may be united. The fingers on the inner side of the hand are most frequently affected.

Simply cutting the fingers apart is very unsatisfactory treatment, because it is almost impossible to keep them from growing together again.

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* "Annals of Surgery," January, 1896.

Didot's operation is the best one (Figs. 108 and 109). In this operation two flaps are made, one on the dorsal and the other on the palmar surface. On the dorsal surface of one finger a longitudinal incision is made from its base to the edge of the web, and at each end of the incision a transverse incision is made, thus making a flap, as seen in the cut. On the palmar surface of the adjoining finger a like flap is made. These flaps are dissected up and the remainder of the web cut through. The flap on one finger covers the raw surface on the other, and no raw surfaces are left, so that there is no danger of the fingers growing together again.

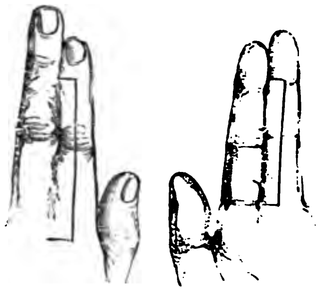

Fig. 108.—Didot's operation for webbed fingers.

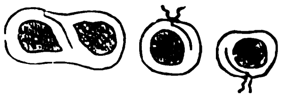

Fig. 109.—Transverse section, showing flaps before and after suture.

Dupuytren's Contraction.—This name is applied to a deformity of the hand characterized by a drawing of one or more fingers toward the palm by a contraction of the palmar fascia (Figs. 110 and 111).

Etiology.—Many theories concerning the etiology have been advanced, but none are proven. Adams teaches that gout is the cause in the majority of cases, but American writers have not found it so. Rheumatism is believed by Keen * to be a common cause. Abbe † suggests that it is probably of nervous origin. Many believe that it is of traumatic origin. The fact that a prominent English writer advocates the gouty origin, and that a prominent American writer advocates the rheumatic, would naturally lead to the conclusion that these two diseases are merely coincident, gout being much more common in

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* *Philadelphia Medical Times*, March 11, 1882.

† *New York Medical Record*, March 3, 1888.

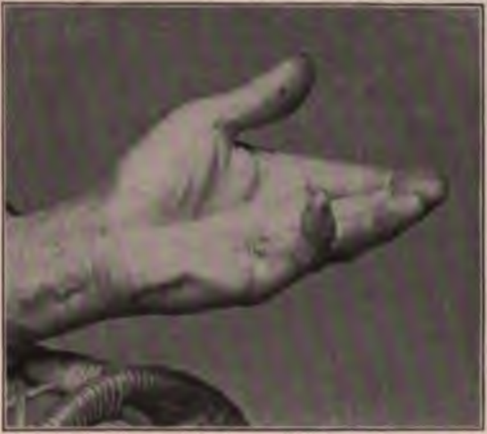

Fig. 110.—Dupuytren's contraction.

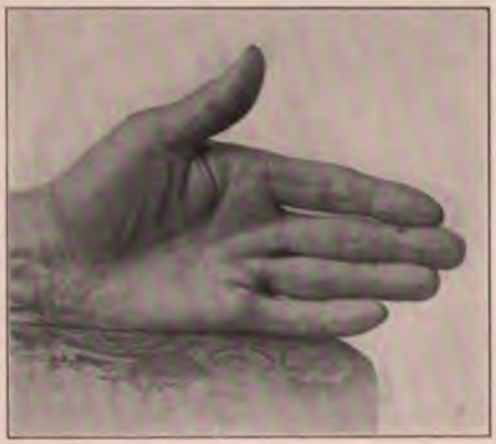

Fig. 111.—After Adams' operation.

England than in America. Rheumatism and gout are very common affections at the age when these contractions occur. Against the traumatic theory is the fact that it occurs almost as frequently in the left as in the right hand, and that it is of frequent occurrence among professional and business men, who are not often exposed to traumatism.

All of the cases seen by the writer have been in physicians, clergymen, and business men.

Pathology.—This deformity is entirely due to contraction of the palmar fascia, the tendons and integument taking no part whatever in the matter. The writer is inclined to the belief that it is inflammatory in character, and that the inflammation may be brought about by many different causes.

Symptoms.—This deformity comes on in middle and old adult life. It occurs in males in the majority of instances, and may occur in one or both hands, the right hand a little more frequently than the left.

The first symptom is a little fibrous nodule in the fascia near the junction of the fingers with the palm. A number of these nodules may be present when the deformity is well developed. They are found to be fibromata. From this small beginning, the trouble gradually extends, and may draw one or more fingers down until they touch the palm. Bands of fascia stand out that look as if the tendons were surely involved; but careful dissections have shown that they never are, and that when the skin is involved at all, it is very slightly, and evidently secondarily. The ring finger is most frequently involved, and the little finger next; then come the middle and index fingers. The thumb is least frequently involved of all. The progress is very slow, taking years to produce a severe deformity. The patient first notices a stiffening of one finger, and later of others, but upon examination it will be found that only extension is interfered with. Neuralgic pains are not infrequent.

Diagnosis.—The diagnosis is not difficult, and can usually be made from the appearance and the history. When the deformity is due to a scar, the scar tissue can be seen, and there is a history of a burn or traumatism.

Prognosis.—The prognosis is very favorable under proper treatment. The deformity can be entirely overcome by operative measures, and shows little tendency to relapse.

Treatment.—Medical and mechanical treatment are useless. Dupuytren advised open incision of the bands, and under aseptic treatment this is a good method. Adams recommended numerous subcutaneous tenotomies. Abbe recommends numerous open incisions. Others have recommended a longitudinal open incision with frequent transverse cutting of the bands. It has also been recommended to dissect out the whole band. Under modern aseptic treatment the open method is undoubtedly the best. When the band is broad, a sufficient number of transverse cuts should be made to allow the fingers to be straightened. When the band is quite narrow, a longitudinal incision may be made and the band dissected out. When it is broad it will not do to dissect it out, because the cicatrix would be so large that it might draw the finger down.

After the long incision, the wound should be closed with fine stitches, but after the multiple transverse cuts an ordinary dry surgical dressing should be applied. No attempt should be made to hold the fingers perfectly straight for the first few days, because it is painful and unnecessary. If any splint is applied, at first it should hold the fingers partly flexed. After a few days a straight splint should be applied and the fingers kept straight until healing has taken place. As soon as the wounds are thoroughly healed, the splint should be removed and the patient encouraged to use the hand, moderately at first.

CHAPTER XV.

DISEASES OF JOINTS; NEUROMIMESIS.

In no department of surgery have more radical changes taken place within the past few years than in diseases of the joints. The vast majority of joint-diseases are either acute or chronic inflammation. In the acute inflammations, we have learned that the dangerous or suppurative variety is always due to the presence of pyogenic germs, and, consequently, can undertake to prevent or cure it more intelligently. Instead of directing our efforts toward reducing the heat, redness, and other symptoms, we endeavor to remove the cause, and allow nature to do the rest. In our knowledge of chronic joint-inflammations the changes are no less wonderful. The term scrofula, which formerly meant so little and yet covered up so much of our ignorance, has, fortunately, almost disappeared, and in its place we have tuberculosis, a term which has a definite meaning based upon scientific knowledge.

Acute and chronic inflammations of joints differ not only in the length of time they consume, but also, as a rule, in their pathologic nature. It is very rarely that an acute joint-inflammation becomes chronic. The vast majority of chronic joint-inflammations are tubercular from the beginning.

Joint-diseases are classed as synovitis, osteitis, or arthritis, according as they pertain to the synovial membrane, the bone, or all the joint structures. In many cases the disease extends from its original starting-point to the other structures of the joint. In some of the chronic joint-inflammations it is often difficult and at times impossible to differentiate between a synovitis and an osteitis.

Simple Acute Synovitis.—Simple synovitis is an acute inflammation of the synovial membrane which ends in resolution. As a primary affection, it is caused by traumatisms, but is very frequently secondary to other inflammations and diseases. It is very often secondary to inflammation of one of the bones entering into the structure of the joint. Synovitis is a frequent local manifestation of some systemic disease. It occurs as a complication in rheumatism, gonorrhea, pyemia, pneumonia, gout, syphilis, and the exanthemata. Simple synovitis is accompanied by comparatively little fever, rarely above 101° F. There is some local heat, pain, and swelling. The latter is usually the most marked symptom, and motion causes pain. It is a rare exception when this disease becomes suppurative or chronic. The pathology is that of a simple serous inflammation without suppuration.

The diagnosis is easily made from the swelling and the moderation of all symptoms. If the temperature should rise above 102° F. in a case where the patient is not already suffering from some febrile disorder, suppuration should be suspected.

The prognosis in simple acute synovitis is good.

The treatment consists of keeping the part at rest by means of splints, and applying moderate pressure by bandages. When the effusion is great it should be drawn off with a small trocar, under aseptic precautions. Washing out the cavity with medicated solutions is unnecessary and may do harm.

Chronic Synovitis or Hydrarthrosis (Fig. 112).—This is a rare disease and seldom occurs in any joint but the knee. It is, as a rule, a simple subacute inflammation from the beginning, although it does occasionally follow an acute attack. The effusion may be thin and watery, or it may be thick and gelatinous. The secondary changes are very slight. There is a gradual thickening of the synovial membrane, and the effusion may become so great as to stretch the ligaments and weaken the joint. The causes are injury, rheumatism, gonorrhea, and loose bodies in the joint. Active inflammatory symptoms are wanting. The swelling usually becomes quite marked, and there is apt to be ligamentous crepitus. It is to be differentiated from tubercular synovitis by the fact that in the latter the enlargement is due almost exclusively to thickening of the serous membrane, with very little effusion. The prognosis is good.

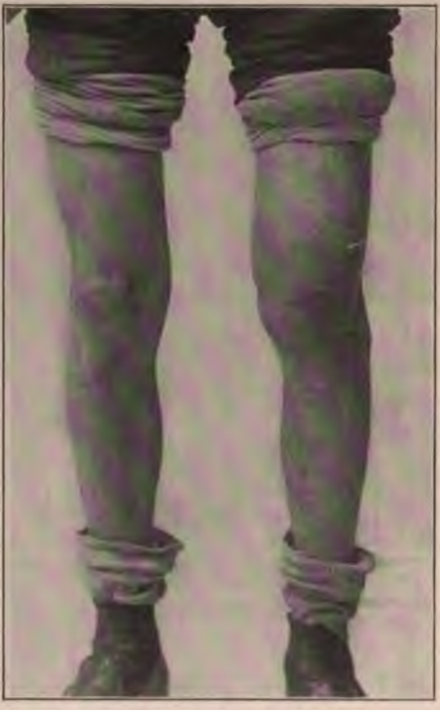

Fig. 112.—Hydrarthrosis of left knee.

The treatment consist of drawing off the fluid and washing out the joint. The writer has treated these cases with great satisfaction by passing two small trocars into the joint, one on either side, and, after draining off the fluid, passing a current of warm bichlorid solution, 1 : 4000, through the joint. Every antiseptic precaution must be exercised and the leg kept in a plaster cast, with the patient in bed for at least two weeks, after which massage and moderate use are indicated. An elastic bandage should be worn for some time. Some patients suffer considerable pain, and have slight reaction for the first twenty-four hours after this irrigation, but after this there are no uncomfortable symptoms. In very few instances has it been necessary to perform the operation more than once or twice.

Acute suppurative synovitis is a very grave disease, and is pathologically an acute suppurative inflammation of the lining of the joint. The tendency is to extend rapidly to surrounding tissues. The symptoms usually begin with a chill, which is followed by a high temperature and severe pain. The joint is hot and extremely sensitive. There is swelling and sometimes redness. The swelling is quite characteristic, since it is not confined to the joint but extends up and down the areolar tissue. The joint becomes flexed and the membrane is rapidly destroyed, so that the cartilages and bone are apt to become diseased. When a large joint like the knee is involved, and the symptoms are not promptly relieved by treatment, the patient suffers from repeated chills and sweats, and rapidly becomes emaciated. The cause of acute suppurative synovitis is the presence of pyogenic micro-organisms, and their entrance way is most frequently through an open wound.

The *diagnosis* is easily made from the above-described local symptoms and the peculiar boggy swelling. The temperature ranges from 103 to 105° F.

The *prognosis* is grave in every case so far as the function of the joint is concerned, and when a large joint is involved prompt and efficient treatment is required to save life and limb. Suppuration once established in a joint, it is never safe to promise that ankylosis will not follow. The granulation tissue which forms on the surface of the synovial membrane has a tendency to become organized and to unite the bones by firm connective tissue. This tendency must be borne in mind when treating a case of this kind.

The *treatment* must be prompt and vigorous. Free openings must be made into the joint and large drainage-tubes introduced. The danger lies in making too few and too small openings. In the knee, for example, at least four openings should be made at once—one on each side of the patella above and below. Should the temperature continue high after these openings, it will be necessary to make one or two openings through the under side of the joint. They are best made by passing a large blunt probe down through the upper openings and cutting down upon the point of it through the popliteal space. The joint must be thoroughly irrigated with a warm normal salt solution. The tubes must be so placed as to reach the bottom of all the pockets in the joint. After thorough irrigation a moist surgical dressing should be applied, and the limb supported by a splint in the position in which it would be most useful should ankylosis occur—viz., the flexed position for the elbow and ankle, and the straight for all other joints. The writer prefers a light plaster cast as a splint. The dressings must be changed and the irrigation repeated at least once in twenty-four hours until the temperature is reduced to a point of safety, which is 99 or 100° F. The surgeon must ever be on the alert lest burrowing of pus take place. Every such tendency must be met promptly by free incision. Should the temperature continue high in spite of the above treatment, it is because there are pockets in the deeper parts of the joint that are not being drained, and the joint must be laid wide open and packed temporarily with gauze. In the knee, for example, the patella should be sawn across and packed temporarily with gauze, as first recommended by Mayo.*

When the temperature is reduced, the patella should be wired and the limb dressed as before. Before resorting to extreme measures, the surgeon must always be sure that there is not some other point of infection causing the temperature. This treatment must be continued until suppuration and temperature have disappeared. The drainage-tubes must not be removed until the discharges have ceased.

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* See "Annals of Surgery," vol. xxi, p. 37.

While ankylosis is always to be feared in these cases, it is the least of the patient's dangers, and should be given secondary consideration. It should always be remembered that the danger of ankylosis lies in the inflammation, and not in keeping the joint quiet for too long a time, and that premature passive motion by breaking down new tissue will only open new entrance ways for pyogenic germs, and thus increase the very danger we are trying to avoid. Passive motion should not be attempted until suppuration has ceased and the temperature is normal, no matter how long this may be, for in cases mild enough to allow hope of recovery with motion the time will not be long, and in severe or protracted cases passive motion will be useless. At first blush the above-outlined treatment may seem unnecessarily heroic, but in competent hands it is perfectly safe and offers the very best results attainable in these cases. In the hands of the writer this treatment faithfully carried out has saved useful limbs in cases that by any less heroic treatment would certainly have resulted in amputation or death. The greatest danger is that the gravity of the condition may not be recognized until after the joint is destroyed and life and limb are endangered. In cases that have been treated early and have promptly responded to treatment, passive motion should be resorted to as soon as suppuration has ceased and the temperature is normal, with a view of restoring motion in the joint. Judiciously carried out, this course will restore joints that have been very severely inflamed. In cases, however, in which the synovial membrane and cartilages have been destroyed, it will be folly to make any such attempt. These cases are sometimes even followed by bony ankylosis.

Acute Suppurative Arthritis of Infants; *Epiphyseitis; Acute Osteitis of Growing Bones.*—Under these headings acute suppurative inflammations affecting the joints of young children have been grouped.

An acute suppurative synovitis occurs in children under four years which Krause has found to be due to the presence of streptococcus pyogenes. It may be excited by injury or it may occur with the exanthemata. It gives the symptoms of a phlegmon, and usually yields promptly to free incision and drainage. It attacks the hip, knee, shoulder, and elbow-joints. There is another disease usually placed under this heading that is of a graver character than the above-described disease, and which begins at or near the epiphyseal line. It occurs in the hip-joint, and has been well described by Macnamara * under the name "epiphyseitis." It is an acute osteomyelitis.

The symptoms all point toward an acute inflammation of the hip-joint. There is excruciating pain and high temperature, followed by deformity and swelling. The joint is so deep-seated that redness does not occur. The symptoms are much more acute than in tubercular osteitis of the hip. There is apt to be an early separation of the epiphysis, with rapid destruction of the hip-joint. The treatment consists of free incision and drainage. The opening should be large enough to admit a finger, in order to ascertain whether the epiphysis is separated or not. If separation has taken place, the epiphysis should be removed at once. This is a grave disease, but with prompt treatment the writer has seen cases recover that were seemingly beyond help.

Injuries of Joints.—Injuries of joints may, for convenience of study, be divided into penetrating and non-penetrating injuries.

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* See "Diseases of the Bones and Joints," p. 437.

A penetrating wound of a joint, whether it be contused, incised, or lacerated, is always a grave affair, and upon an early appreciation of this fact by the patient and attendant often depends limb or life. While the chances of a safe recovery are infinitely better now than in pre-antiseptic days, we are all the more responsible for bad results because we understand the causes of suppurative inflammation so much better.

The *prognosis* after an opening into a joint depends upon whether germs gain entrance into the joint, and everything done by way of examination or treatment should be done with this fact in mind. The diagnosis of penetration is usually made from the escape of synovial fluid, but in case of doubt the probe should not be used. The size of the wound has comparatively little to do with the result, since infection may take place through a small wound as well as a large one.

The *treatment* must be upon the strictest antiseptic lines. When called to treat a penetrating wound of a joint the surgeon's first duty is to make sure that no dirt or foreign substance of any kind is left in the wound. When the wound is a clean cut made by a sharp instrument, no examination of the interior of the joint is necessary, but when the wound is dirty, contused, or lacerated, such an examination may be necessary, and, if so, should always be made with an aseptic finger. When the wound is clean cut, it and the surrounding parts must be thoroughly cleansed and sterilized. The wound may then be closed with interrupted sterile sutures and a large surgical dressing applied. The member should be put at rest by a plaster bandage or other splint, and, if a large joint is involved, the patient must be put in bed. Where little or no reaction follows, this dressing should be left for a week or ten days, when the wound will be found to have healed, after which the patient must wear a splint for a longer or shorter time, according to the severity of the injury and the size of the joint. Should the temperature rise above 101° F., or continue above 100° F., the dressings should be removed. If the edges of the wound are reddened, the stitches must be removed, the wound gently cleansed, and the dressings re-applied. If the patient has a chill, or if the temperature runs up to 103° F., with severe pain and other indications of a severe local inflammation, no time should be lost, but the joint must be opened, drained, and irrigated as directed under treatment of acute suppurative synovitis.

When the wound is torn and evidently dirty, it must be cleaned with soap, water, and scissors, and finally with a 1 : 2000 bichlorid solution. It should then be packed with sterile gauze and covered with a moist surgical dressing, which must be changed when the discharges show at the edges of the dressing or when the temperature rises. If all germs have been removed or destroyed, the wound will heal by granulation without high temperature or other unfavorable symptoms.

Frequently the surgeon is called in after some days have elapsed and inflammation has set in. This is apt to occur in cases where the wound is a slight one and the patient has thought little of it until it began to pain him. If the symptoms are moderate, it is evident that but a few germs have entered, and they may be confined to a limited space near the opening. In such cases it is proper to cleanse the parts, do only such irrigating as can be done through the wound, drain, apply a moist dressing, and await developments. Should the temperature fall, it is evident that the germs have been destroyed and the prognosis is good; but, on the other hand, should the temperature rise, free openings, drainage, and irrigation must be resorted to at once. The aftertreatment should be the same as for acute suppurative synovitis.

Non-penetrating Wounds of Joints.—Contusion of a joint may be due to a fall or a blow, and varies from a slight "bruise" to a severe crushing injury with fracture extending into the joint. A severe crushing injury to a large joint (hip or knee) is liable to result in death from shock. Contusion of a joint may be due to indirect violence ; for example, a hip may be contused by a fall upon the foot. The most important symptom of contusion of a joint is effusion of blood within the joint-cavity. It can be readily recognized, when of sufficient quantity to be of consequence, by the sudden swelling and flexion of the joint, followed by discoloration. It is only when the effusion is so great as to cause severe pressure and pain that it is necessary to remove any of the blood, since it remains fluid and is rapidly absorbed. When necessary, it may be removed through an aseptic trocar or aspirator needle.

The *treatment* consists of massage, pressure, and early use. Fracture into a joint requires additional treatment for the fracture, and will not admit of early use. Too early passive motion when fracture extends into the joint is a mistake, and, by increasing the amount of bony callus and adhesive inflammation, does more harm than good.

The prognosis in simple contusion with effusion of blood is good. Contusions of joints are rarely followed by suppuration, but may be followed by tubercular inflammation.

Sprains.—A sprain is a contusion of a joint, usually caused by a sudden twisting, which produces a temporary subluxation with more or less laceration of the ligaments and capsule of the joint. By the forced motion beyond the normal limit the joint surfaces are contused and fragments of bone are sometimes chipped off. The symptoms are acute pain and swelling, with helplessness of the joint. The swelling is due to the effusion of blood into the joint and surrounding soft parts. The diagnosis is to be based upon the above symptoms, great care being exercised to exclude fracture. At the wrist, a chipping off of the margin of the radius, known as " Barton's fracture," may be found. At the elbow a severe sprain is quite likely to be accompanied by a fracture. At the ankle, the most frequent location of a sprain, fracture of either malleolus may occur. The injury to joint and ligaments, or sprain, is the most serious part of the well-known Pott's fracture. An injury of the knee may be accompanied by dislocation of a semilunar cartilage, which is sometimes a serious matter.

The *treatment* consists of rest, pressure, and massage for the earlier periods, with passive motion and use for later periods. It is a mistake to insist that an injured joint must be used from the first to prevent ankylosis. Those who insist that the joint must be moved every day, say that motion is the natural physiologic condition, and is necessary to the well being of the joint, forgetting that we are dealing with pathologic rather than physiologic condiditions. No one would think of insisting that an injured eye should be used to prevent blindness. Fortunately, "ankylophobia" is not so common as it was a few years ago. At the surgeon's first visit he should apply a well-fitting bandage to a sprained joint, and order either hot or cold applications, according as it is winter or summer. It is now well understood that the ultimate result is the same after the application of the two extremes of temperature, so that the patient's comfort may be considered. As soon as the limit of swelling has been reached, the writer believes the best treatment for severe cases is to apply a plaster-of-Paris bandage with the part in a proper position. This should be changed as soon as it becomes loose from a reduction of the swelling. In milder cases where ligaments and joint capsule are not seriously injured, a cloth bandage with massage will be all that is necessary. In the severe cases, after a couple of weeks the plaster cast should be cut up so that it can be readily removed and re-applied, and the joint thoroughly massaged every day. In no class of cases is this valuable measure so useful as in this. With the above-outlined treatment the prognosis is good, even in severe sprains. It is a common belief among the laity that a "sprain is worse than a break," and this belief is well founded upon improper treatment. (For Sprained Ankle, see chap. xx.)

Old sprains are frequently brought to the attention of the surgeon. They are usually due to the fact that the rest-treatment has been overdone, and massage and passive motion have been neglected. Too much rest is just as bad as too much motion for an injured joint. It is this abuse of rest that gave rise to the fear of ankylosis and led to the other extreme. An old case should be examined with great care to differentiate between a neglected sprain and a beginning tuberculosis. The sprain will give a more acute history, and will have been painful all the time when moved, but usually comfortable while at rest. There may or may not be swelling. No noticeable local rise of temperature is present; on the contrary, the part is often cold and blue.

A local tuberculosis seldom follows a severe injury, but as a rule follows a slight injury, and is accompanied by spasm, atrophy, and the characteristic swelling. These old sprains should be broken up under anesthesia, and this should be followed by persistent passive motion, massage, and moderate use.

Inflammation of Joints Occurring in the Course of Other Diseases.—Joint-inflammations occur in the course of pyemia, rheumatism, gonorrhea, puerperal fever, small-pox, erysipelas, diphtheria, dysentery, pneumonia, mumps, glanders, and in tabes and syringomyelia. Those occurring in the acute infectious diseases are often suppurative, and the bacteria characteristic of the original disease are usually found in the joint—*i. e.*, the pneumococcus and gonococcus. They are polyarticular, and usually run an acute course, although not, as a rule, so severe as a traumatic suppurative arthritis. The writer saw one case in a patient suffering from puerperal fever in which there was a mild inflammation of one shoulder-joint and suppurative arthritis of the hip so severe that at the autopsy the entire head and two inches of the shaft of the femur were found to be destroyed.

These cases give rise to the same symptoms as an acute suppurative synovitis, and require the same treatment. Should the patient recover, the prognosis as to the usefulness of the joint is usually good.

A milder form of joint-inflammation occurs during convalescence from acute infectious diseases, which is often monarticular. It is a subacute synovitis, and although often somewhat protracted, usually makes a perfect recovery under treatment by rest.

Gonorrheal arthritis, or gonorrheal rheumatism, is, as a rule, a serofibrinous synovitis, rarely ending in suppuration. It occurs in the majority of cases during the first month of the urethritis, and is probably due to the presence of the gonococcus of Neisser, although its presence cannot always be demonstrated. The cases ending in suppuration are probably due to mixed infection. This disease may be polyarticular but it is, as a rule, monarticular, and the knee and ankle are its favorite locations. The diagnosis offers no difficulty, and the prognosis is usually that of a simple synovitis.

Persons who have suffered from the affection once are very liable to attacks every time they contract a gonorrhea, which is some evidence in favor of the belief held by some that it is only persons of a peculiar diathesis who suffer from this disease.

Acute Rheumatic Arthritis.—This affection, under the name of acute articular rheumatism, comes under the care of medical practitioners rather than surgeons, and usually entirely recovers under medical treatment. The cause of the joint affection is the same as that of the general febrile condition in rheumatism, whatever that may be. The various theories as to the cause have not been proven. Reasoning from analogy, however, it is rational to conclude that rheumatism is a systemic disease due to a microorganism, with the joint-inflammation as a local manifestation. The arthritis affects all of the structures, particularly the ligaments and tendons. The effusion is fibroserous, although it has been known to become purulent. There is one very important diagnostic point to be borne in mind, and that is, that rheumatism is a polyarticular disease, and that *an inflammation confined to one joint is not rheumatism.* Rheumatism occasionally remains in one joint for a long time after having affected a number of other joints. The most common error in the diagnosis of joint-diseases, both acute and chronic, is to mistake other inflammations for rheumatism.

The *treatment* of this disease is that of simple synovitis added to the medical treatment laid down in works on practice of medicine for rheumatism.

Chronic Rheumatic Arthritis, or Rheumatoid Arthritis.—Under these titles several diseases are doubtless described, having different causes but accompanied by very similar anatomic changes. That some cases are rheumatic is proven by the fact that they occasionally follow acute rheumatism. Attempts at differential diagnosis are very unsatisfactory, so we shall not undertake it, but shall, for convenience, describe them as one. When we learn the cause of rheumatism we may hope to learn something of the causes of the others. At the present writing we must admit that we are deplorably ignorant concerning the causes of this group of diseases, and are unfortunately very unsuccessful in our treatment of them. This affection is a polyarticular disease of adult life, usually running a subacute course from the first, and is extremely chronic. All the joints of the body may be affected. The anatomic changes are the formation of new connective tissue in the cartilage, in the synovial membrane and surrounding parts, which gradually contracts so that the joint slowly stiffens and grows smaller. The joints become deformed, and bony ankylosis may follow. The cartilages are worn through and the underlying bone becomes eburnated. This irritation of the bone sets up a rarifying osteitis which is accompanied by bony deposits around the margins, helping to cause the ankylosis that so frequently follows.

The first symptoms are sharp pains in different joints, a stiffening of the joints in the morning which improves in the course of the day, swelling, and a creaking sound with motion. The patient usually gets better and worse alternately, and is very fortunate if he eventually recovers with a crippling of a few joints. All of the joints may become ankylosed.

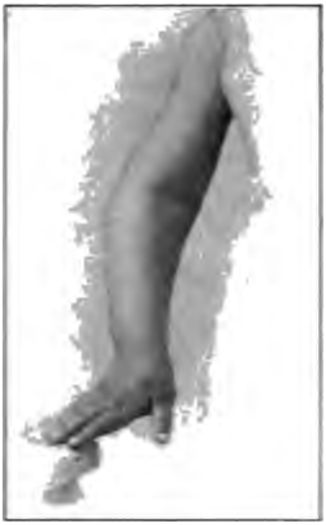

Fig. 113.—Syphilitic arthritis of elbow and of carpo-metacarpal joint of thumb; characteristic atrophy of tuberculosis absent.

The medical *treatment* employed in acute rheumatism is only of moderate value in these cases. The prognosis is bad under any treatment, but the patient's chances are very greatly improved by residence in a warm, dry climate. When the joints are not too sensitive, massage with passive motion is followed by improvement. In some cases a thorough breaking up under anesthesia may be tried, as it sometimes yields good results. In extremely sensitive cases the above plan is not applicable, and it will be better to place the affected joints in proper position under anesthesia, and apply plaster casts, hoping for speedy ankylosis.

Syphilitic Arthritis (Fig. 113).—In the eruptive stage of syphilis an acute polyarthritis sometimes occurs which is a simple synovitis, ending favorably under the same treatment applicable to a like condition from other causes, added to the special treatment for syphilis. In the later stages a chronic arthritis sometimes occurs which usually accompanies gummatous deposits in the periosteum, medulla, or synovial membrane. In these cases there is apt to be destruction of bone. Chronic syphilitic arthritis may resemble tubercular arthritis so closely that it will require a careful microscopic examination to differentiate between them, but the diagnosis can usually be made from the presence of other syphilitic lesions.

The ***treatment*** of these cases does not differ from that for like conditions from other causes.

Charcot's Disease (Spinal Arthropathy) (Figs. 114 and 115).—Under this title we have a joint-inflammation that occurs in the course of tabes dorsalis or locomotor ataxia. It resembles rheumatoid arthritis, but is believed to be due to degenerative changes in the nerves supplying the joint, which are due to the cord lesion. It occurs, as a rule, after the central lesion has been diagnosticated, but may occur while the lesion is still overlooked. Charcot claims that arthropathies are present in ten per cent. of all cases of tabes, but others have not noticed so large a percentage.

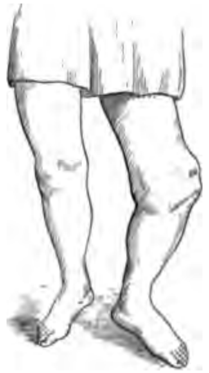

Fig. 114.—Ataxic knee-joint.

It appears suddenly as a painless swelling, and may, in the course of a day or two, assume considerable proportions. It is at first, seemingly, a simple synovitis, but later definite anatomic changes take place. It is pathologically a rarefying osteitis. The synovial membrane is thickened, and the cartilage is gradually destroyed by fibroid degeneration. Both are entirely destroyed at points where pressure is greatest, and the ends of the bone worn down so that crepitus can be felt. Around the edges of the bone and at points where there is no pressure, osteophytes form.

The ligaments are softened and destroyed. Dislocation usually occurs, and fracture is not of infrequent occurrence. The knee- and hip-joints are usually affected, but it may occur in other joints. The joint becomes quite useless from destruction of the ligaments, but there is little pain on account of the analgesia due to the tabes. This analgesia probably has something to do with causing the joint-lesion, because the patient sustains a contusion without knowing it. Unfortunately, treatment is of comparatively little value. At an early stage, proper orthopedic appliances that will keep the joint at rest and keep weight off of it will

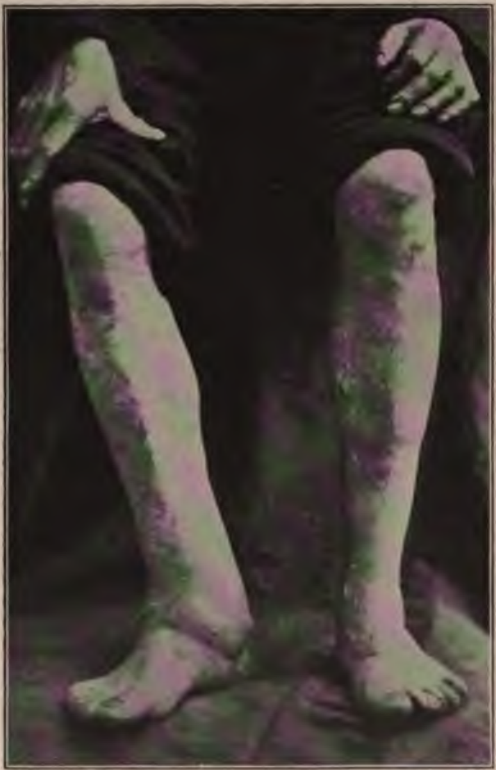

Fig. 115.—Ataxic ankle-joint (Ketch).

delay the progress of the disease, but cannot be expected to effect a cure. Amputation and excision are useless, and quite liable to be followed by death.

Syringomyelia is sometimes accompanied by an arthropathy resembling Charcot's disease, but is usually in the upper extremities because they are most affected by the spinal lesion.

Arthritis deformans is usually a polyarthritis, although it sometimes affects but one large joint. It occurs in persons past middle life, and runs a subacute and very chronic course. It most commonly occurs in the hip (Fig. 116), knee, elbow, and shoulder, but when polyarthritic may affect the small joints of the fingers and toes. It causes deformities in the joints affected. It resembles very closely, and is often confounded with, rheumatoid arthritis. Degen-

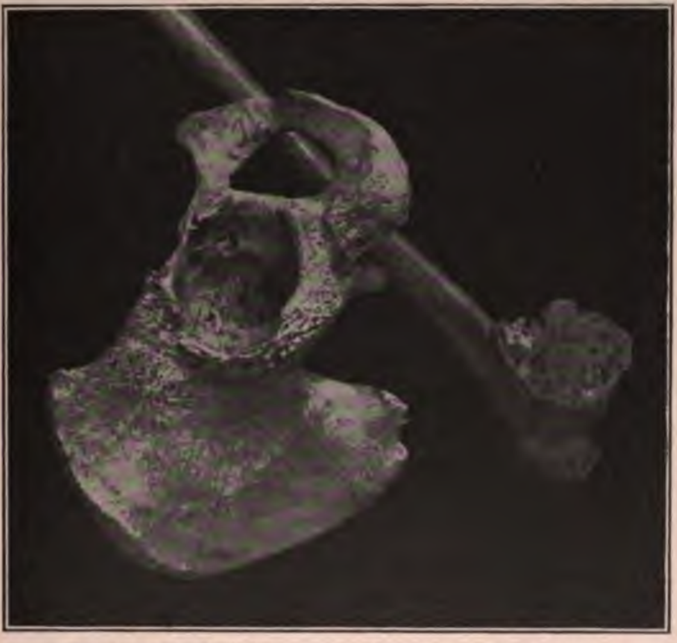

Fig. 116.—Arthritis deformans, or morbus coxæ senilis (Hendricks).

erative processes take place in the bone and cartilage ; the bone becomes atrophied. The entire head and neck of the femur may disappear. At the edges where there is less pressure there is new formation of bone. The cartilage undergoes the same changes—*i. e.*, absorption where there is pressure, and new formation where there is less pressure. The ligaments and capsule become thickened and afterward contracted. Motion is always much limited, and may be entirely lost, although the joint does not become obliterated nor the joint surfaces adherent.

In some cases the atrophic changes predominate to such an extent that the joint becomes loose and subluxation may occur. The femur may be dislocated and form a new acetabulum on the dorsum of the ilium.

This disease runs an extremely chronic course, and is characterized by a gradual stiffening of the joints. There is usually no fever, but at times there may be acute exacerbations accompanied by great pain. The cause of this disease is not known, but it sometimes follows other affections of the joints, and may be excited by an injury. The prognosis is bad, for, although the disease does not materially shorten life, it continues until the end of life.

The *diagnosis* is easily made from the age of the patient and the peculiar deformity.

The medical *treatment* of this disease consists of building up the patient and regulating his functions. Prolonged administration of iodids and the like do no good, and are apt to do harm by interfering with digestion. Much good can be accomplished at times by massage and passive motion. The writer has known patients to be greatly benefited by the hot baths at Hot Springs. Excisions have been performed in extremely painful cases, sometimes with satisfactory and at other times with unsatisfactory results.

Loose Bodies in Joints.—These bodies may consist of bone, cartilage, fat, or fibrin. They may be entirely loose in the joint or may be attached to the inside of the joint by a pedicle (Fig. 117). The most frequent variety is the fibrinous or rice bodies. They are composed mostly of fibrin, and are believed by many modern writers to be of tubercular origin. The bacilli cannot be readily detected, but inoculation of guinea-pigs with them produces tuberculosis. Senn says that their presence in a joint or tendon sheath is positive evidence of tuberculosis. They vary in size from that of a grain of rice to a horse-chestnut, and are most frequently found in the knee-joint, but occasionally in others. They are a frequent occurrence in the so-called non-tubercular arthritis. Doubtless many loose bodies were originally attached but became broken off.

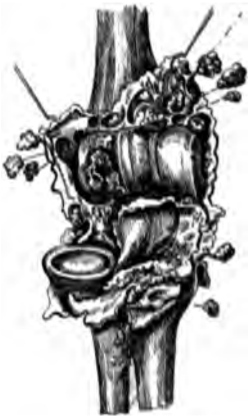

Fig. 117.—Nodules of fibro-cartilage, some attached by elongated pedicles, and some loose (Cruveilhier).

The *symptoms* are quite characteristic. The patient will be attacked by a sudden, severe pain in the joint while it is in motion. He may become faint and fall. The joint seems to be suddenly paralyzed. The pain is evidently due to the pressure upon the synovial membrane from the loose body which has been caught between the joint surfaces. An acute or subacute synovitis frequently follows an attack of pain, and these attacks are almost certain to be repeated.

The *diagnosis* is to be based upon the peculiar pains, and offers little difficulty except when the bodies accompany a chronic inflammation of the joint.

Any *treatment* short of the removing of the offending body is only palliative, but should always be resorted to unless the case is a severe one and is interfering with the patient's usefulness. The best palliative treatment is the wearing of an elastic bandage over the joint. When the body can be located underneath the skin the operation is easy to perform. When it cannot be located it may necessitate a very free opening of the joint.

The strictest antiseptic precautions should be exercised even in the simplest cases, the wound closed, and the joint put at rest.

Hysteric Joint, or Neuromimesis.—This condition makes its appearance both as a paralytic affection and as a deformity due to contraction of muscles. It is a pure hysteric affection and has no pathology. It should always be suspected when a joint affection occurs with well-marked hysteria. It usually occurs in hysteric females at about the age of puberty, although it may occur at any age, and in males. The hip and knee are its favorite locations. The causes are the same as those of hysteria. The joint is apt to be exquisitely sensitive, but can be moved without causing pain if the patient's attention can be attracted to something else. Sometimes there is a slight swelling, but there is no heat or atrophy. It develops suddenly, and is apt to be accompanied by paralysis of the bladder, aphonia, globus hystericus, and other hysteric symptoms. There is no spasm, and the electric reaction is normal. The diagnosis can be readily made from the above description, but it should be remembered that a hysteric affection may be added to a diseased joint, when all the symptoms are exaggerated. When in doubt, an anesthetic may be given, when all symptoms due to hysteria will disappear.

The treatment is that of hysteria. No apparatus should be applied and no operations are indicated. Tonics and out-of-door life are indicated. Electricity and massage are useful. The prognosis is good, although the trouble is sometimes quite protracted.

CHAPTER XVI.

TUBERCULAR ARTHRITIS.

WHEN all chronic inflammations were called scrofulous, the general belief was that they were due to constitutional causes, and were treated accordingly.

We now know that the tubercle bacillus is omnipresent, and that when given a proper *locus minoris resistentiæ* it may develop in any person, no matter how healthy he or his ancestors may be. That a certain condition does often exist which renders one person more liable to a tubercular inflammation than another, and that that condition may be handed down from parent to child, few will deny ; but that it is a disease, or cause of disease, *per se*, the writer does not believe.

A strumous or scrofulous patient is one who has diminished power to resist the encroachment of the tubercle bacillus. Modern pathologists have enunciated a number of ingenious theories as to what this lack of resisting power is, but they are only theories. The trend of thought, however, is toward the belief that this defect is in the cell.

"White swelling" is a term that has been extensively applied to chronic joint-inflammations, but it is no better than scrofula, from a pathologic standpoint.

Laennec was the first to teach that some joint-diseases are tubercular, and he was soon followed by Virchow and Volkmann. Many at that time believed in the microbic origin of tuberculosis, but none were able to prove it until 1882, when Robert Koch discovered the bacillus. The time has almost passed when it is necessary to offer proof that the tubercle bacillus is the cause of tuberculosis ; it is sufficient here to say that it is always found where tuberculosis exists, and that artificial tuberculosis can be produced by injecting the bacilli into animals.

The facts that the vast majority of chronic joint-diseases are tubercular, and that tuberculosis is due to the presence of the tubercle bacillus, and that the bacillus is not peculiar to certain individuals, have a practical bearing upon the prognosis and treatment in these cases. In short, joint tuberculosis is a local disease, and should be treated as such. It is the surgeon's duty to put forth every effort to prevent the local disease from becoming general. It is rarely that tubercular joint-disease ends fatally, except when some other more vital part becomes secondarily affected. During the scrofulous era, writers were content to say that the cause of scrofulous joint-disease was constitutional. While we know now that the bacillus is the cause of tubercular joint-disease, we also know that certain auxiliary conditions are necessary for the development of a local tuberculosis. The fact that tubercular inflammation is so frequent in children, and that it begins, as a rule, in some center of growth or development, would indicate that growing tissue offers the necessary requirements for its development. The writer believes that an injury, in the vast majority of cases, offers the *locus minoris resistentiæ* for the lodgment and development of the tubercle bacillus in joint-disease, because he has seen so many cases in which the disease could be directly traced to an injury that he is satisfied that the same cause exists, frequently, when overlooked. Just as a severe injury is liable to be followed by the ordinary phenomena of an acute inflammation, so is a slight injury liable to be followed by a tubercular inflammation. It is usually the active child of the family who is most subject to falls and accidents who develops a joint tuberculosis.

The writer has not observed that the children of healthy parents are more exempt from these diseases than others. The fact that some tubercular taint can be found in the family history provesn othing, for few families are free from such taint, and by this *post hoc ergo propter hoc* reasoning most diseases could be proven to be due to a hereditary taint. The writer, some time ago, took the trouble to look up the family history of a series of patients suffering from simple fracture, and had no difficulty in finding a tubercular history in almost every instance.

"Tubercular arthritis" is a term that can be conveniently used in speaking of tubercular inflammations of joints, since it includes all cases and has a pathologic significance. The various conditions described under the terms fungus synovitis, chronic suppurative arthritis, tuberculosis of joints, tumor albus, and scrofulous diseases of joints, are all covered by this term. Most tubercular diseases of joints begin as an osteitis, the synovitis being secondary. A minority begin as a synovitis. The cartilage is rarely, if ever, the original seat of this or any other joint-disease.

Causes.—The cause of this disease is the presence of the tubercle bacillus. The exciting cause is undoubtedly very frequently a slight contusion, the contused spot affording the *locus minoris resistentiæ*. Severe injury is very rarely followed by tuberculosis. The bony type predominates in children, while the synovial type is more frequent in adults.

Pathology.—In the bony type, the whole epiphysis, or a small wedge-shaped piece, may become necrosed. The cartilage may be pushed off *en masse* by granulations underneath, or it may first be covered with a thin layer of granulation tissue, extending from the margins of the cartilage, where it joins the synovial membrane, forming the so-called pannus growth. Later, the cartilage softens, becomes fibrillated, and changes into fibrous tissue. This fibrous tissue becomes infiltrated with tubercle and breaks down, forming an ulcer in the cartilage through which direct communication is established between the joint-cavity and the tubercular spot in the bone. A cold or tubercular abscess may form in the bone and break into the soft parts outside of the joint, producing a periarthritis. By close observation the surgeon will generally be able to recognize this condition, and by timely surgical interference may save the joint. For a time before the tuberculosis breaks through into the joint-cavity there is an increase of pain and a rise of temperature due to the above-mentioned changes on the joint surface. At the time when an abscess breaks through there is a decided rise of temperature.

In the synovial type, the synovial membrane is thickened and covered with pale, spongy granulations. The joint contains a serofibrinous exudate. The fungous variety is due to exuberant granulations, and they may be so soft as to give a sense of fluctuation. The writer has often had patients sent to him to have the knee "tapped" when it was simply full of these soft granulations. They push their way into every surrounding tissue, destroying it. Later they undergo cheesy degeneration and break down, forming a cold abscess. A periarthritis accompanies this condition, and may break down and lead to cold abscesses which may or may not communicate with the joint. The older the patient, the more likely this is to occur. In the synovial variety of joint tuberculosis the bones become affected, but it is comparatively superficial.

The "caries sicca" of Volkmann is a synovitis with slowly developing granulations, extending gradually through the cartilage into the bone, causing atrophy and ankylosis without abscess. It usually occurs in the shoulder of young adults, and continues for about two years without the usual symptoms of tuberculosis.

In tubercular joint-inflammations, the capsule and soft parts around the joint are transformed into a gelatinous mass that led Brodie to use the term "gelatinous disease of the joints." This is most marked around the knee-joint, and may extend some distance up the thigh. This is not tubercular deposit, but is evidently some change brought about by the presence of the tubercle bacillus.

Osteophytes occasionally form around a tubercular ulcer, due to an inflammation of the periosteum.

Symptoms.—The onset of this disease is usually insidious, and the original focus may lie dormant for a long time. The patient first complains of a stiffness and pain, the latter being worse at night. In a superficial joint, swelling, with local heat that can be detected by a sensitive hand, are observed; the extremity becomes enlarged at the affected joint and atrophied elsewhere, presenting quite a characteristic appearance; the veins become enlarged, and the skin whiter than normal: hence the name "white swelling." The amount of pain varies greatly in different cases, and at different times in the same case. One of the characteristics of this disease is that exacerbations occur, during which all symptoms are exaggerated and the patient suffers greatly. These exacerbations may continue from a few days to several weeks. They often occur when the disease is evidently progressing favorably; they are helpful in prognosis, since they become less frequent and less severe as the patient improves.

The joint is somewhat fixed by muscular spasm from a very early period. Orthopedists depend more upon this spasm of the muscles as a means of diagnosis than upon any other one symptom. Where no spasm exists, the disease is not present. It is due to reflex irritation of the nerves supplying the joint. This spasmodic action would seem to be an effort upon the part of nature to protect the joint. It is, however, the cause of most of the patient's suffering, and, by increasing the pressure between the joint surfaces, it helps to cause ulceration of the cartilages.

Unless prevented by early and efficient treatment, deformity always occurs in this disease. The joint becomes flexed at first, and later may become subluxated. It was formerly taught that the flexion was due to effusion within the joint, but it is undoubtedly largely due to muscular contraction. The thickening of the synovial membrane and enlargement of the epiphyses also help to produce the deformity.

The atrophy accompanying this disease is probably largely due to trophic changes, for, while non-use and bandaging increase the amount of atrophy, it occurs before bandages are applied and while the patient is still using the joint. The patient's general health is only seriously interfered with during an exacerbation or when some important complication exists. Most of the time the temperature is normal, but during an exacerbation it may rise to 101° or 102° F. A very frequent complication of tuberculosis of joints is cold abscess. The center of a tubercular nodule breaks down and forms a caseous mass which becomes infiltrated with fluids and leukocytes, forming a tubercular abscess. It is surrounded by a layer of granulation tissue filled with tubercles. This pus is much thinner than the pus of acute abscess, and is almost white. It contains cheesy masses, and sometimes particles of bone. A culture from this pus produces tubercle bacilli in abundance, although they are not easily demonstrated in the pus itself by the microscope.

Pyogenic germs take no part in this process, so it cannot be said to be true pus. When the pus cocci are found, we have a mixed infection accompanied by the rise in temperature and other symptoms belonging to acute suppuration. The abscess wall, or tuberculous membrane, is quite characteristic, and can easily be scraped away. It is separated from the healthy tissue by a dense, fibrous membrane. This membrane is caused by a protective inflammation, and contains no tubercle. It was formerly believed that these abscesses were due to an independent periarthritis, but recent observations go to show that they usually connect with the original seat of disease through small fistulæ.

Prognosis.—Tubercular arthritis is a chronic disease, usually running from one to three years and often longer. The prognosis with reference to life depends upon the age of the patient, the location of the disease, and the complications. It is rarely that tubercular arthritis causes death *per se*, but through various complications it is estimated that from 25 to 27 per cent. die. The prognosis is much more favorable in children than in adults, but when neglected or poorly treated few children reach adolescence, and very few who have suffered severely live to be over fifty years of age.

The complication causing death most frequently in adults is pulmonary tuberculosis. With them tuberculosis of the carpus almost invariably ends in this way. In children, tubercular meningitis and amyloid degenerations carry off a larger percentage. The amyloid changes take place in the kidneys and liver, and usually occur in cases where there has been prolonged suppuration. This change is not accompanied by tuberculosis of these organs, and is not necessarily fatal. Cases of undoubted amyloid degeneration of the kidneys, as evidenced by the usual symptoms, frequently recover after removal of a tubercular joint-disease by operation.

In children the prognosis with reference to the usefulness of the joint is good, when early and proper treatment is adopted ; but when neglected, the disease is almost certain to end in deformity, and often in ankylosis. Abscesses and sinuses add to the danger of ankylosis, but a good serviceable joint may often be obtained, notwithstanding their presence.

The prognosis as to usefulness of the joint in adults is not so good as in children ; recovery is apt to be very slow, and quite a large percentage require operative procedures. Operative procedures, with the exception of excision of the knee, are not so successful as in children. Operations upon the ankle and tarsus are practically useless. The writer believes that a well-developed tuberculosis of the ankle or tarsus in the adult is best treated by amputation.

When a cure takes place, it is by the absorption of the tubercular tissue and its replacement by healthy granulation tissue which becomes organized. The soft parts may contract so as to form false ankylosis. Sequestra and tubercular masses may be absorbed. Abscesses may be entirely absorbed. Cheesy masses may remain indefinitely, but so long as they remain there is danger of a relapse. True bony ankylosis may follow. In the bony type, atrophy usually follows, although hypertrophy sometimes occurs. In atrophy, the medullary tissue is increased and the cortical tissue diminished in both epiphysis and diaphysis. The growth of bone may be interfered with by destruction of the epiphyseal cartilage. Relapses are liable to occur, and are probably due to remaining cheesy foci rather than to a new attack.

Diagnosis.—The diagnosis of tubercular arthritis should offer little difficulty after the characteristic symptoms are well developed, but it should be made before marked deformity and irreparable pathologic changes have taken place, because it is at this stage that the best results can be obtained by treatment. Various joints have special symptoms that will be considered when these special subjects are discussed, but the symptoms common to all are so characteristic that diagnosis, even at an early period, is comparatively easy. The term "arthritis" has been chosen by the writer because it covers the disease regardless of its original location. It is frequently difficult and sometimes impossible to make a differential diagnosis between a tubercular synovitis and a tubercular osteitis, but fortunately it is not necessary, because the treatment and prognosis are practically the same. Our knowledge of the original seat of disease has not been gained from clinical experience, but from operations and postmortems.

Family history is of little value in making a diagnosis, because the disease is found even among the few who have a perfect family history, and the fact that the patient's ancestors died of tuberculosis in no proof that his joint trouble is tubercular.

Tubercular arthritis is usually monarticular, occurs more frequently in childhood, and is accompanied by a swelling at the joint and atrophy of surrounding parts. When there is a change of color, it is a peculiar white. There is flexion and, later, subluxation. Limitation of motion and reflex spasm are present from a very early period, and they are the symptoms to depend upon in making an early diagnosis. Every child who limps or complains of pain in a joint should be carefully examined. The smallest amount of atrophy or deformity should be noticed. Very gentle motion should be made in both the well limb and the painful one, comparing the amount of resistance in the two corresponding joints. If a tuberculosis is beginning, the affected joint will require more force to move it, and the amount of motion will be less. When the affected joint is gently flexed by the surgeon, he will feel a spasmodic jerking of the muscles that is quite characteristic of this disease. Rough handling is contra-indicated, and obscures the symptoms. An anesthetic should not be given, because it overcomes the spasm. These symptoms are beautifully illustrated in a beginning tubercular arthritis of the hip. At the present time the tendency is to pronounce every chronic- bone or joint-disease tubercular, just as we formerly applied the term scrofula to them. It is important, in the interest of exact knowledge, and with reference to prognosis and treatment, that this error be overcome.

The most common error is in pronouncing the disease rheumatism. This mistake should not be made, because rheumatism is a polyarticular disease, while tuberculosis is monarticular. Monarticular rheumatism in children practically never occurs. It is said by very good authority to have occurred a very few times, but the writer has never seen a case. The so-called chronic rheumatism, or rheumatoid arthritis, is a disease of adult life, and is polyarticular.

An acute osteomyelitis may be mistaken for a beginning tubercular arthritis at first, but it is an acute suppurative inflammation of the shaft of the bone, and the high temperature and other acute symptoms will soon develop, so that there need be no difficulty. Osteomyelitis sometimes destroys a joint, but the acute history will be sufficient to establish the diagnosis. Syphilis is sometimes accompanied by disease of the bone that bears a strong resemblance to tuberculosis, but the history, together with the fact that syphilitic bone-disease is usually confined to certain favorite locations (usually the bones of the head), should be sufficient to establish the diagnosis.

It should be remembered that osteosarcoma beginning in the epiphysis of one of the long bones may bear a very striking resemblance to tuberculosis. At an early stage it is practically impossible to make the differential diagnosis, but later the malignant disease assumes a more serious aspect, and can be readily diagnosticated. Many cases are on record where a beginning sarcoma was pronounced tuberculosis, and in a few instances excisions have been performed for sarcoma, the operator believing the disease to be tuberculosis.

"Bleeders," or persons suffering from hemophilia, are sometimes afflicted with a joint trouble peculiar to this disease, known as a bleeder's joint, or a hemophiliac joint. The disease is characterized by an effusion of blood into the joint, which may remain fluid for a long time, finally coagulating. When the patient is known to be a bleeder and the joint swelling has come on suddenly the diagnosis is easily made, but when the patient does not know that he is a bleeder the diagnosis is extremely difficult, because, aside from the sudden onset of the disease, the symptoms are very like those of tuberculosis, and after it has existed for some time the sudden onset may be forgotten or lost sight of, as in the writer's case reported below. Rest, with gentle pressure, is the treatment for a hemophiliac joint. Recovery sometimes takes place, but the prognosis is grave.

While it is usually a comparatively easy matter to make a diagnosis in tubercular arthritis, it is possible to be mistaken, as illustrated by the following cases:

CASE I.—A young man, nineteen years of age, came to the writer with a knee which had been pronounced tubercular by a number of physicians who had seen it. It had already been treated by iodoform and iodin injections. He gave a history of having sustained a slight injury about a year before the writer saw him, and some time afterward the joint began to swell and became painful.

When he came to the writer he had a large white joint with enlarged veins. There was flexion, atrophy, muscular spasm, and severe pain which was much worse at night. He was put in bed and extension made by means of a weight and pulley.

In about a month his pain was relieved, the deformity overcome, and the swelling diminished.

At this time there was no question in the writer's mind but that the knee was tubercular. A plaster cast was applied and the patient allowed to go out on crutches.

After a very few weeks the pain returned, the swelling increased, and the patient went to bed, where he remained until he died three months later from an osteosarcoma. At that time the writer's belief was that the sarcoma was secondary to tuberculosis, but the probability is that it was sarcoma from the beginning.

CASE II.—A lady, forty-nine years of age, who had a knee which was decidedly enlarged and which had been pronounced tubercular by many of the eminent surgeons of three different cities, was brought to the writer for treatment. An independent diagnosis of tubercular synovitis was made and an excision advised.

There was local swelling and heat, and what seemed to be a tubercular abscess in the popliteal space. There was flexion and tenderness upon pressure, but comparatively little pain. The family physician, acting upon the advice of a consulting surgeon, had tapped the joint some time before, drawing off quite a quantity of serous fluid, after which he injected iodin.

The patient accepted the advice of myself and all the other surgeons (except one who wanted to try iodoform injections), and requested me to excise the joint. The patient had a hemophiliac joint, and died one week after the operation from acute anemia.

These rare and unexpected cases may occur in any joint, but the above are the only cases occurring in the writer's experience.

Treatment.—There is no specific medical treatment for tubercular arthritis. So long as the patient is well nourished no medication is indicated; but when he is run down, tonics and aids to digestion are indicated. The writer's favorite is maltine, with pepsin and pancreatin; taken with a little wine, it will frequently stimulate the patient's flagging energies. So long as the digestive apparatus is in good condition more is to be gained by the use of concentrated nourishment in some such form as that mentioned above than from drugs. Cod-liver oil has been, and is still with many, a favorite, but it is a food rather than a medicine. When it does not disturb digestion, it answers a very good purpose. The writer seldom prescribes it, however, because it disagrees with many, and good rich milk and cream are cheaper and better. Opiates are to be avoided, because the disease is chronic and the patient is in great danger of acquiring the opium-habit. It is cruel to give opiates to children for months and then deprive them of them.

Local applications are very popular with the laity, and, where they do not interfere with the mechanical treatment, should be used, for while they have no direct curative effect they have some anodyne effect, and the patient feels that more is being done for him. Chloroform liniment and camphorated oil are as good as any. Dry heat frequently affords relief from pain, and can be applied by means of bags of salt, or rubber bottles filled with hot water. Occasionally the writer has found an ice-bag afford more relief than anything else.

Counterirritation by blisters, moxæ, and the hot iron were very popular at one time in the treatment of tubercular joint-diseases, but have little to recommend them. Compression is a valuable agent in the treatment of these cases. Many appliances used in the treatment of tuberculosis of the knee owe their beneficial effect largely to the pressure they produce.

The vast majority of these cases are best treated by mechanical methods. A few years ago it was quite the fashion to operate upon many of these cases, particularly hip-joint cases, as soon as the diagnosis was made, but the results were not satisfactory, and the practice has practically been abandoned. Many results at first seemingly brilliant proved ultimately to be very poor, owing to the interference with the growth of the limb. It is now an established principle among orthopedic surgeons that operations are not to be performed until mechanical treatment has failed, or until specially indicated, because mechanical treatment affords the best results. The great principles of treatment in these cases are *rest* and *protection.*

By rest, we mean that there shall be no motion in the joint, and by protection we mean that the joint shall bear no weight. The principles are alike for all joints, but the methods of application necessarily vary with the different joints. Much discussion has been indulged in among American orthopedists as to whether tubercular joints in the lower extremity shall be treated by fixation or by traction. English orthopedists have given little attention to traction, being quite satisfied with fixation. The advocates of traction claim that by this method the joint surfaces are lifted apart, and protected from the evil effects of the pressure caused by the spasmodic action of the muscles, and they have conclusively demonstrated by experiment that traction does distract, or separate, the joint surfaces. Those opposing this method of treatment claim that it is impossible to separate the joint surfaces by traction, on account of the resistance of the muscles and because of the tendency to a vacuum. They also claim that fixation controls the muscular spasm just as well as traction, and that traction is only one way of producing fixation. Even if the tractionists had not so clearly proven that traction does distract, it would seem rational to expect that traction would relieve spasm and reduce intra-articular pressure. The child, too young to reason, instinctively attempts to perform traction by pushing upon the dorsum of the foot of the afflicted side with the foot of the well side. Every surgeon knows from experience that he can relieve a child of its extreme pain and gain its confidence by making gentle traction with his hands.

Notwithstanding all this evidence in favor of traction, the stubborn fact remains that those who employ fixation without traction get just as good results as the tractionists.

The writer's experience teaches him that all cases do not do equally well under the same treatment; that while the vast majority of cases can be treated satisfactorily by fixation alone, a certain few will suffer much less pain and progress more favorably with traction.

At the beginning of treatment, when the patient has some deformity and is suffering pain, nothing will relieve him so surely or so quickly as rest in bed and extension by means of weight and pulley. The pain will be relieved, the deformity overcome, and the patient will gain rapidly in flesh and strength. At a later stage, or when the patient is not suffering so severely, it will not be necessary to put him in bed, since a proper mechanical device can be applied at once. There is no appliance or material so universally applicable for putting the part at rest as plaster-of-Paris. If the affected part be a lower extremity, protection should be secured by an elevated shoe on the well side, and a pair of crutches. It is of very little value to apply a plaster cast to a knee or hip and allow the patient to use the limb. If extension is required, some one of the various long splints will be necessary. The principle of all these splints is the same. Most of them have a ratchet-and-key arrangement by which the amount of traction can be regulated, and are attached to the foot or leg, and have perineal straps for counterpressure. These appliances are very ingenious and very convenient for the surgeon, but the writer, after an extensive experience with them, is satisfied that it is only in exceptional cases that they are really necessary; the majority of his best results having been secured by fixation by means of plaster-of-Paris, and protection by means of the high shoe and crutches. The previously-mentioned traction appliances are very efficient in skilful hands, but do not yield as good results in unskilled hands as the simple fixation appliances. They are, however, preferable to the clumsy iron appliances so much used in England for fixation of the hip, because they are more sightly and just as easy to apply and manage.

If, at the beginning of treatment, a moderate amount of deformity exists, it can be overcome by simply applying a plaster cast with the limb in the best attainable position. At each change of cast, which should be weekly at first, the new cast will be slightly straighter than the old one.

In older cases, where the deformity is quite fixed and the joint not very painful, the better way is to give the patient an anesthetic and overcome the deformity at once, performing tenotomies when necessary, and using the hands only. Too great force must not be used, lest the epiphysis be separated. Much has been said against this method by the overconservative orthopedists, but the writer knows from personal experience than in cases where there are no sinuses, and where the disease is not very active, this is a safe and efficient treatment.

Ankylosis is not to be feared from prolonged fixation, for where it occurs it is due to the disease and not to the fixation. Every orthopedist knows that he can confine a healthy joint almost indefinitely without ankylosis following. Massage is a very valuable means of treatment during convalescence, when we are trying to restore motion, but it should not be used during the active stage of the disease for fear of causing general tuberculosis.

A very important question that the surgeon is called upon to decide is, when to remove the apparatus. No attempt should be made to remove it until four (or better, six) months after all active symptoms have disappeared. At this time, the appliance should be removed and massage with gentle passive motion employed. After a few days, if all goes well, the patient may begin to use the joint very carefully. If there is gradually increasing motion without spasm, the joint is well. If motion diminishes or spasm develops, the brace should be reapplied. Swelling and a certain amount of pain are always to be expected, at first, whether the joint is well or not. When complete ankylosis has taken place, the absence of pain and local heat are sufficient evidence of a cure.

The injection of a ten per cent. emulsion of iodoform into tubercular joints has been highly recommended by a number of eminent surgeons, and bids fair to be a valuable addition to other treatment. It should not, however, be allowed to interfere with the mechanical treatment. The writer's experience in this treatment is too limited to justify a positive opinion for or against it, but he is bound to admit that, thus far, his results have not been nearly so satisfactory as those reported. In cold abscesses, however, particularly psoas abscesses, results have been very much better.

Operative Treatment.—A large number of cases of tubercular arthritis coming under the care of a surgeon at a late date, and a small percentage of those that have been under the best of treatment, will require operative treatment. The operations indicated are arthrectomy, excision, and amputation. An arthrectomy consists of removing diseased tissue only, and may be followed by a movable joint. An excision consists of removing not only the diseased part, but also a portion of the healthy bone, and in some joints—for example, the knee—ankylosis is sought. In no branch of surgery have the two extremes of practice been so well illustrated as in this. At the one extreme are the orthopedists, who apply braces to every case, and who never operate; at the other extreme are the surgeons, who operate on every case, and who do not employ orthopedic measures. Of these two extremes, the orthopedists have much the better of it, because their mortality-rate is smaller and they get a greater number of useful joints. In surgery, as in everything else, the best is not to be found in the extremes. Fortunately, there has sprung up within a few years a class of orthopedic surgeons who are both orthopedists and surgeons, who do not treat cases after certain stereotyped methods, but who treat each case according to its indications. It is impossible for one who is not familiar with both methods of treatment to be a first-class judge as to which is the better form of treatment in a given case. Where one who has had ample experience in both orthopedic and operative treatment is in doubt in a certain case, he should always choose the orthopedic method. One seeking for brilliant results from operations should not operate upon tubercular cases, for they certainly do not yield such results.

It is difficult to lay down general rules as to when an operation should or should not be performed, because the indications vary at different ages and in different joints. It may be said, however, that when a joint is badly deformed or is pierced with sinuses, showing that suppuration is going on or that necrosed bone is present, an operation is indicated. Then, too, when the patient's general condition is so bad that general tuberculosis is to be feared, a radical operation that will remove all of the diseased tissue will often be a life-saving measure.

Arthrectomy consists of laying a joint freely open and removing all diseased tissue with scissors and scoop. The advantages of this operation are that enough healthy tissue may be preserved to secure a movable joint, and that in children enough of the epiphyseal cartilage may be saved to continue the growth of the limb. The disadvantages are that it is not so thorough as excision, and is consequently more likely to be followed by failure, and that the dangers of causing a general tuberculosis are greater. One danger in all operations upon tubercular disease is that foci of disease may be set loose and enter the system, causing general tuberculosis. The writer, however, is satisfied, after an extensive experience, that this danger is not nearly so great as is generally believed. An Esmarch bandage should always be used when performing an arthrectomy, to enable the operator to see what he is doing. A 1 : 2000 bichlorid solution can be used very freely, but should be followed by sterilized water before the bandage is removed. The wound should be packed with iodoform gauze, and if, after a few days, it is found to be aseptic, secondary suture may be resorted to. If, for any reason, arthrectomy should be resorted to before sinuses have formed, the wound may be closed immediately and primary union sought. Should the wound be septic, it will be necessary to continue the packing until it is closed. Rubber drainage-tubes should not be used, because their track is almost certain to become tubercular. This operation is especially applicable in the knee-joints of children, because excision is contra-indicated in these cases on account of the interference with the growth of the limb. It is very important in this operation, as in excision, to remove every focus of disease. For the hip-joint excision is a better operation.

Excision is the operation most frequently indicated in these cases, and while it should never be resorted to so long as the joint is progressing favorably under mechanical treatment, it is wrong to postpone it when it is evident that a case is not likely to improve under the milder treatment.

Excision is best adapted to the hip-joint in children and the knee-joint in adults. It is a useless operation in the ankle of adults, for, notwithstanding the 35 methods that have been suggested to perform it, the operation is unsatisfactory, and relapse is almost certain to follow. The mere fact that deformity or sinuses exist in a given case is not an indication for excision, but when the deformity cannot be overcome by milder means, or when total disorganization of the joints is taking place and the patient's general health is suffering too greatly, this operation is indicated. It is very important when performing an excision to remove every focus of disease.

Amputation should be resorted to when it is evident that the disease will not yield to other treatment, or where the patient's general health demands speedy relief from the local disease. Amputation is very rarely necessary in children, but in adults is often the truly conservative treatment. Amputation for incurable hip-joint disease is not nearly so grave an operation as the same operation for other causes. This operation is sometimes necessary after excision has failed. When there is imminent danger of general tuberculosis, amputation is the operation of choice.

Cold abscesses frequently call for surgical treatment. The extreme conservatives do not interfere with an abscess, but allow it to pursue its course unmolested. So long as the abscess is small, this is good and safe treatment. Sometimes such an abscess will entirely disappear by absorption. When an abscess is large, or increasing, it should be emptied, and it is in these cases that the writer has secured the most satisfactory results from iodoform. The contents should be evacuated through a large trocar or through a small incision, and the cavity thoroughly washed out with a 1 : 2000 bichlorid solution. It is well to follow the bichlorid with sterilized water; the writer has, in one instance, had severe salivation follow when this precaution was neglected. After the irrigation, a ten per cent. aseptic emulsion of iodoform in olive oil or glycerin should be injected. The quantity of emulsion should vary from half an ounce to three ounces, according to the age of the patient. The abscess wall has very little power of absorption, so that the fear of poisoning from either the mercurial solution or the iodoform is very slight. Every aseptic precaution should be exercised, for the only danger in this treatment is that the cavity may become infected with pyogenic germs, when the patient will have a suppurative inflammation added to the tuberculosis, and will be much worse off than if the abscess had been let alone. The iodoform should be sterilized by washing in bichlorid solution, and the glycerin or oil by boiling, before they are mixed. The emulsion should be kept carefully sealed until used. This operation will usually have to be repeated twice or three times at intervals of ten days or two weeks. The small opening should be carefully closed by a pad of gauze, and a full surgical dressing applied. The simple opening of a tubercular abscess and draining with rubber tubes will not yield satisfactory results. Mixed infection is almost certain to follow.

Another method of treating these abscesses has been practised considerably, and that is to lay them wide open and scrape out the tubercular lining. When this is undertaken, it is necessary to find the sinuses communicating with the original seat of disease and scrape them out, too. After the curetting, the cavity may be iodoformized and the wound closed or the cavity may be packed with iodoform gauze. Three or four days after a packing, if the wound is aseptic, it may be closed by suture. When it is not aseptic it must be kept packed until it is healed. There are two very serious objections to this last method of treatment: one is, that it is difficult to reach all of the diseased surface, and, unless all is reached, the operation will fail; and the other is, that there is danger of general tubercular infection. When the whole abscess-cavity can be reached, the writer believes this to be the best treatment, but when only a part can be reached, it is better not to touch the lining membrane. It is quite a common practice among general surgeons to scrape out old sinuses in tubercular arthritis. The writer only mentions this practice to condemn it, for it is useless and dangerous. The simple scraping of the sinuses, without getting at the root of the disease and cleaning it all out, will do no good, and will expose the patient to the danger of general tuberculosis.

CHAPTER XVII.

HIP-JOINT DISEASE (MORBUS COXÆ; TUBERCULAR ARTHRITIS OF THE HIP).

MORBUS COXÆ is, pathologically speaking, a tubercular osteitis of the hip. The term "hip-joint disease" is very objectionable, but has been in use so long and is so generally accepted that it is difficult to get rid of it. In the vast majority of cases the disease begins at a point in the head of the femur just outside of the epiphyseal cartilage. Occasionally it begins in the acetabulum and in the synovial membrane (Fig. 118).

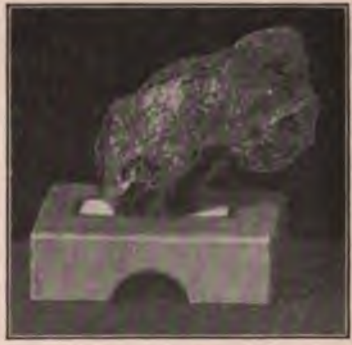

Fig. 118.—Portion of femur removed from patient shown in figure 138, showing the part where disease usually begins.

Cause.—The cause is now believed to be the presence of the tubercle bacillus. The exciting cause is usually a slight injury. It is a disease of childhood, although it occasionally occurs in adults. It is more frequent in males than in females, probably because the former are more likely than the latter to meet with accidents. (For further consideration of causes and pathology see Tubercular Arthritis, chap. xvi.) The tendency is, no matter in what tissue the disease begins, to extend to all tissues of the joint and destroy them. The amount of destruction is sometimes very great. Enough of the head of the bone may be destroyed to cause decided shortening and apparent dislocation. Real pathologic dislocation, however, very rarely occurs. The head of the bone may become entirely separated and act as a foreign body. A certain number of cases begin with all the symptoms of "hip-disease," but yield promptly to treatment, making a complete recovery in a few weeks. These cases are probably cases of simple synovitis and have been aptly called "ephemeral hip-disease."

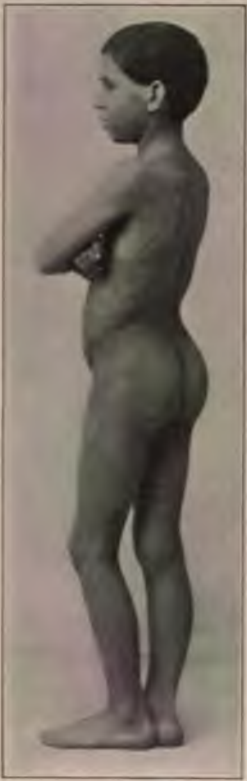

Fig. 119.—Hip-joint disease just beginning, showing slight flexion and disappearance of gluteal fold.

Symptoms.—For convenience of description this disease may be divided into three stages:

First Stage.—The first symptom usually noticed is a slight *limp.* A limp in a child should never be considered a trifling affair, but should always lead to a careful examination of the lower extremities, because it is the first evidence of a number of grave diseases. The hip limp is peculiar and can readily be recognized. It is due to tenderness and muscular spasm. The spasm reduces the amount of free motion in the joint, and, when the patient steps forward with the afflicted limb, instead of bending the hip freely, he bends the spine and swings the pelvis and the limb forward together. *Muscular spasm* and consequent *limitation of motion* develop very early, and are the most important symptoms from a diagnostic standpoint. This spasm is probably reflex, and is due to irritation of the nerves supplying the joint. Nature is trying to put the joint at rest by placing all of the muscles on guard. This constant contraction of the muscles very soon causes *deformity* (Fig. 119). There is always flexion, sometimes with abduction and outward rotation, but more frequently with adduction and inward rotation. Where abduction is present at first it soon changes to adduction. This change is not due to intra-articular pressure, because it takes place when there is no effusion in the joint. It is undoubtedly due to the muscular spasm. When abduction and outward rotation are present there is apparent lengthening (Fig. 120). The afflicted limb seems to be longer than its fellow, whether the child is lying on his back or standing. This position is due to a tilting of the pelvis (Fig. 121). With adduction and inward rotation there is apparent shortening (Figs. 122 and 123). In this stage of the disease the shortening is only apparent, but later may become

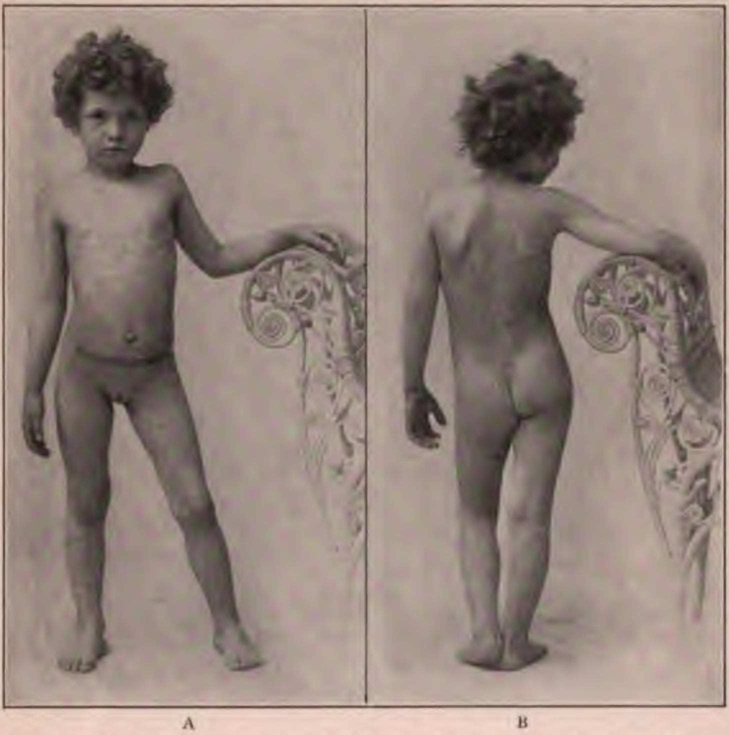
A B

Fig. 120.—A, abduction and apparent lengthening of left leg; B, abduction; flexion; apparent lengthening.

real on account of destruction of the head of the bone. *Pain* may be very slight or very severe in this stage. It is usually a prominent symptom, and is most frequently located at the inner side of the knee. It is located at this point because of direct communication between the nerve supply of this point and of the hip-joint ; but why it should be located here and not in the joint is not easy to explain. The patient may be entirely free from pain all day and yet suffer all night. When the child is suffering and the thigh is flexed, he will usually be found with the bottom of the foot of the well side resting on the instep of the afflicted side, making an effort at extension.

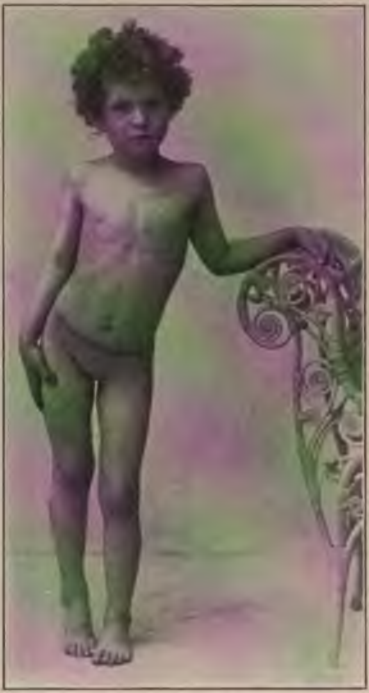

Fig. 121.—Showing tilting of the pelvis in abduction, and apparent lengthening (left leg).

Atrophy of the muscles controlling the joint appears early and is a constant symptom in this disease. The fold of the buttock on the afflicted side usually disappears quite early. Induration of the lymphatic glands above Poupart's ligament is an early and quite a constant symptom. In this stage the general health is little affected.

Second Stage.—This stage is characterized by an exaggeration of all of the symptoms of the first stage. The deformity is increased and shortening may be real. Pain is a constant symptom and "night-cries" begin. This night-cry is quite peculiar; it is a loud shriek, occurring when the child is asleep. The cry may be so loud as to waken others, but the child may not waken. It is probably due to a sudden spasm of the muscles, causing severe pain of short duration.

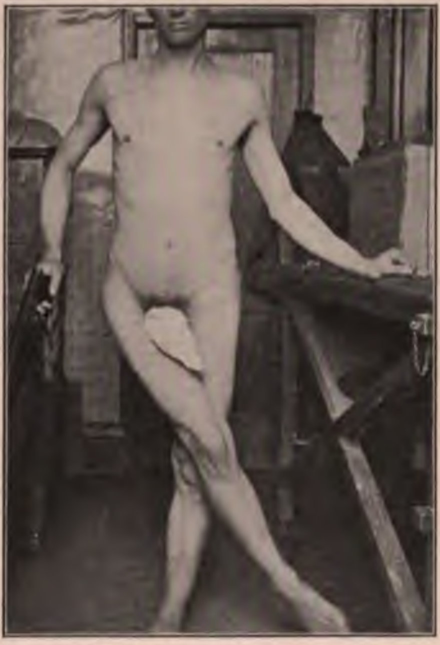

Fig. 122.—Adduction and apparent shortening (Gillette).

Abduction may be present, but adduction is the usual position. The deformity is well marked and atrophy is decided. The limp is increased, and the patient may not be able to stand upon the limb. The fold of the buttock has entirely disappeared and the joint is quite fixed. In short, the symptoms are all so well developed that the laity can make the diagnosis. Unfortunately, it is at this late date that the case usually falls into the surgeon's hands.

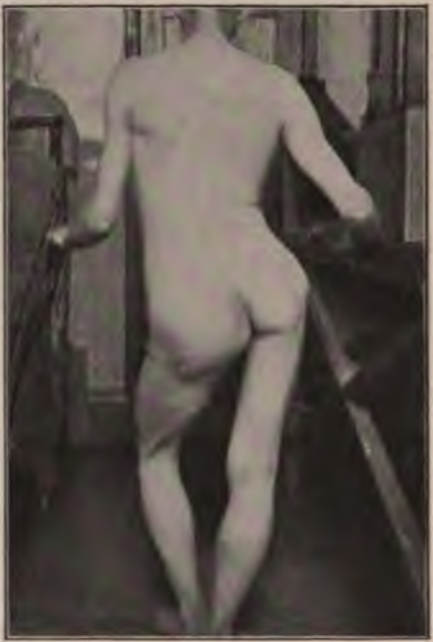

Fig. 123.—Adduction of right leg; apparent shortening; tilting of pelvis (Gillette).

In addition to the symptoms present in the first stage, we have suppuration and abscess, and, if the joint can be moved, crepitation may be felt. The original focus of disease has broken down, and all the joint structures are involved. Abscess as a complication occurs in a large percentage of cases. Sometimes the appearance of an abscess is preceded by an extra amount of pain and fever, but its approach is usually insidious. It usually appears at the anterior margin of the tensor vaginæ femoris, but may appear around the trochanter (Fig. 124). The presence of an abscess usually indicates that suppuration is going on in the joint, although it may be entirely peri-articular, owing to the breaking of the original focus outside of the capsule of the joint. An abscess may form in the pelvis, due to perforation of the acetabulum. At this stage of the disease a peri-arthritis is present and can usually be felt around the trochanter. The temperature ranges from 99° to 102° F., and is greatest when sinuses are present. At the time when the original focus breaks through into the joint, there is a decided rise of temperature, and after an abscess has broken externally the patient suffers from a rise of temperature, due to infection of the abscess-cavity by pyogenic germs. This usually disappears after a few days, but occasionally the patient rapidly emaciates and dies, the high temperature continuing until the last. The general health of the patient usually suffers more or less in this stage.

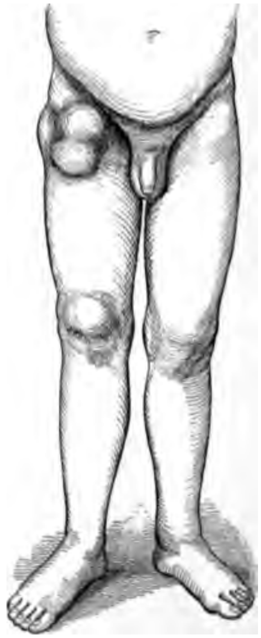

Fig. 124.—Common site of abscess.

Third Stage.—This stage is characterized by adduction, flexion, and shortening. In favorable cases that are prolonged into the third stage, ankylosis usually exists. In unfavorable cases the foregoing symptoms are present and suppuration is going on. The general health suffers greatly, and death occurs from tubercular meningitis, phthisis, and amyloid changes in the liver and kidneys. Many cases drag along in this stage for months, and even years, with ankylosis and sinuses, and finally recover. Real shortening exists, owing to destruction of the neck of the femur, and apparent dislocation is present from the same cause. Real dislocation is very rare in this disease.

Diagnosis.—The diagnosis offers no difficulty in the second and third stages, when the characteristic deformity is present, but it is very important that it be made at an early date in order that the treatment may be successfully applied. The temperature offers no help in diagnosis, because it varies so, and may be entirely absent. The pain located at the inner side of the knee is suggestive but not conclusive. The fact that no pain exists is no proof of the absence of hip-disease, because cases occur without pain. Deformity helps to make a diagnosis, but it is important to make the diagnosis before this symptom is well marked. A certain amount of deformity, however, occurs at a very early date (see Fig. 119). When deformity is well marked and shortening is present, it is important to decide whether the shortening is real or apparent. At an early stage the shortening will be only apparent, but when the case first comes under the surgeon's care it may have existed much longer than the parents have any idea of, and real shortening may exist when all symptoms have been very mild.

The child should be laid upon its back and the limb placed as near the normal position as possible, and the distance between the anterior superior spinous process of the ilium and the tip of the inner malleolus on the diseased side compared with the same measurement on the well side. The amount of abduction or adduction, when present, can be ascertained by drawing a line between the two anterior superior spines and noting the angle between this and the femur of the affected side (see Figs. 120 and 121). To detect slight flexion, place the child upon its back and press the popliteal space against the table; if flexion be present, the lumbar spine will be lifted from the table (Fig. 125).

To ascertain the amount of flexion, place the child upon its back and lift the afflicted limb from the table until the lumbar spine touches the table, and the position of the limb will then show the real amount of flexion (Fig. 126). When flexion is present, the popliteal space and the lumbar spine cannot both be made to touch the table at the same time. The amount of flexion is usually greater than it seems to be when the child is walking, because he compensates for the flexion by bending his lumbar spine. Atrophy of the affected limb is an early and constant symptom in this disease. So long as the patient is able to walk, the atrophy may be confined to the thigh, but later the calf will also atrophy. When the disease is well developed the atrophy is so well marked that it can be readily seen; but at an earlier stage measurement of the circumference of the limbs would be

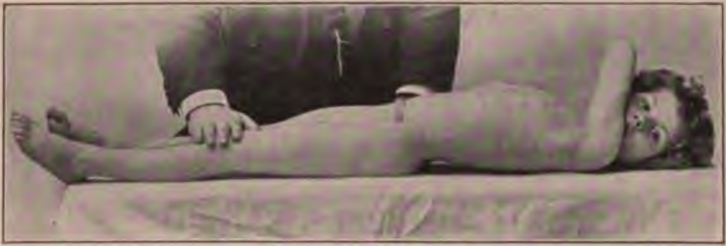

Fig. 125.—Manner of showing amount of flexion.

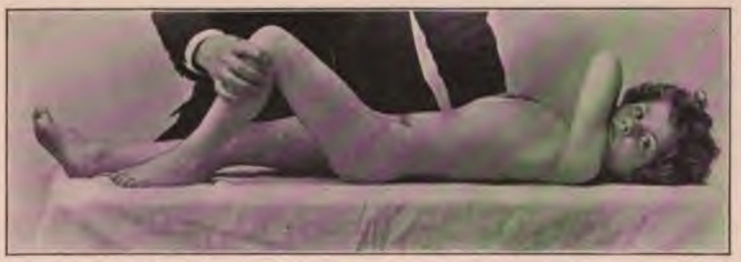

Fig. 126.—When hip-joint disease is present, the popliteal space and the lumbar spine cannot both be made to touch the table at the same time.

necessary. In a doubtful case, it should be remembered that the right leg is often normally larger than the left one. The fold of the buttock usually begins to disappear at an early stage, but it is not a very reliable symptom. It is caused by the atrophy, the position, and the swelling about the joint.

Crepitation is a symptom that may at times be found in the later stages, but it is not necessary for diagnosis, and should not be sought for, since it does such a joint harm to move it. It is bad practice to jar the limb by striking the bottom of the foot or the knee to elicit pain.

The one symptom of more importance than all the others in making an early diagnosis is the limitation of motion caused by muscular spasm. It is the duty of the surgeon to examine carefully for this symptom every child who is brought to him with a limp. The patient should be placed upon his back upon a table or solid couch, with the lower limbs and the lower half of his body nude. Every manipulation should first be applied to the well side in order to test the normal amount of resistance and to gain the patient's confidence. An anesthetic should not be given, because it would overcome the spasm to such a degree that the disease could not be detected at an early stage.

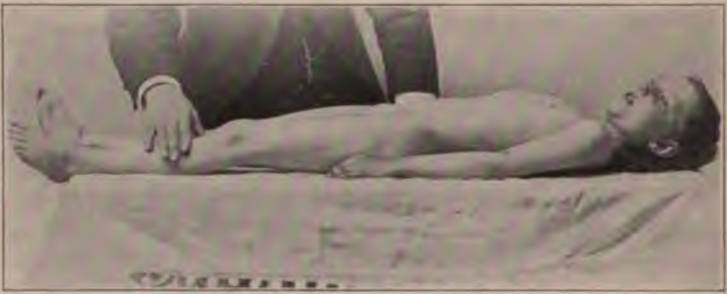

Fig. 127.—Manner of testing for limitation of motion.

The surgeon should place the palm of his hand upon the anterior surface of the patient's well limb, and after the patient has relaxed his muscles, gently roll the limb from side to side upon the table, noting just how much pressure is required to produce this motion (Fig. 127). The same manœuver should be tried with the afflicted limb, and if disease be present in the hip-joint, even at a very early stage, there will be interference with rotation, so that more force will be required to roll it. This, when skilfully performed, is a very delicate and valuable test. If the movements are roughly made, they lose their value.

The surgeon's hand should next grasp the ankle of the well side and flex the leg upon the thigh and the thigh upon the body, carrying it to the limit of flexion. He should then hold the thigh flexed at a right angle to the body and gently rotate, adduct, abduct, and circumduct the hip, noting the amount of motion and of resistance (Fig. 128). He should next grasp the ankle of the afflicted side and put that limb through the same motions. If disease is present in the hip-joint, even at a very early period, when the disease is confined to a small focus in the head of the bone, more force will be required to produce the various motions, and all, particularly flexion, are likely to be somewhat limited.

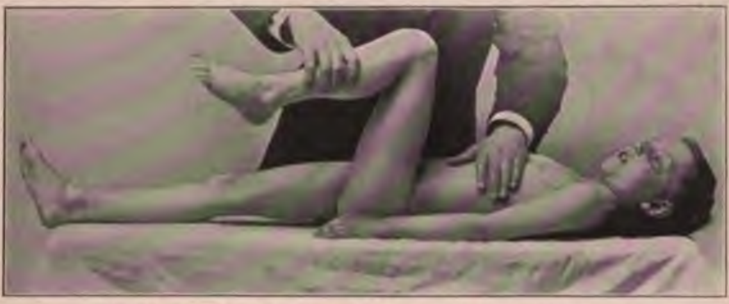

Fig. 128.—Testing for muscular spasm and limitation of motion.

Another very valuable symptom that can be elicited by these manipulations *when gently performed*, is *muscular* *spasm.* The spasm is a gentle involuntary jerking in the opposite direction from that in which the limb is being moved. This is a very constant symptom, but should be noted early in the examination, since repeated manipulations tire the muscles so that the spasm may disappear for a time. When involuntary resistance to motion in every direction is present with muscular spasm, the joint is diseased beyond question ; for while many things may interfere with motion in certain directions, nothing else will give this complete train of symptoms. Spasm will be found in all stages of the disease so long as any motion in the joint remains, and its disappearance is evidence of recovery.

These manipulations can be satisfactorily performed upon patients of any age or degree of refractoriness, providing the surgeon exercises the grace of patience and confines his attentions to the well limb until he has gained the patient's confidence.

The family history is of no value in making a diagnosis ; in fact, it is rather misleading. The general condition of the patient is rarely of value in diagnosis, since the general health is rarely affected until the disease is well advanced. Occasionally the first symptom noted by the parents, and one bringing the case under the surgeon's care, is an abscess. It is, as a rule, a later symptom, and is frequently preceded by an exacerbation of all other symptoms, but does occasionally come early and in an insidious manner. It is characterized by swelling and fluctuation, and is rarely accompanied by special heat or by redness except when it is about to empty itself, when a small red spot will appear.

A number of other affections are to be differentiated from hip-joint disease. It is very frequently pronounced *rheumatism*, but should not be, because rheumatism is an acute polyarticular disease.

Synovitis of the hip is a rare disease, but does occur. It is more acute than hip-disease, and is not accompanied by muscular spasm and atrophy. In synovitis there is eversion and outward rotation.

Pott's disease in the lumbar region may be mistaken for hip-disease, for at a very early period it is occasionally difficult to make a differential diagnosis between these two affections. In Pott's disease there is the characteristic rigidity of the spine, and except where a psoas abscess is crowding directly upon the joint the limitation of motion is in extension only, motion in the other directions being quite free. The patient can stand upon the limb without causing pain, and manipulation of the limb does not cause spasm except in extension.

Congenital dislocation may be mistaken for hip-disease, but lacks all of the characteristic symptoms. The deformity is congenital and free from pain, and is very frequently double. The trochanter projects above Nélaton's line.

Sacro-iliac disease causes a limp that resembles that of hip-disease, but the resemblance stops with this one symptom.

Peri-arthritis may sometimes temporarily resemble hip-disease, but the acute symptoms develop rapidly and the characteristic symptoms of hip-disease are absent.

Infantile spinal paralysis resembles hip-disease in causing a limp and by its accompanying atrophy, but there is no limitation of motion or spasm. It should be remembered that a hysteric patient may have a hysteric hip-joint; but in this affection there is no atrophy, and the muscular spasm relaxes if the patient's attention is directed to something else.

Prognosis.—The tendency in the majority of cases of hip-joint disease is to recover, with a certain amount of deformity and with partial or complete ankylosis. In properly treated cases there is a mortality-rate of from five to ten per cent.; and persons who recover from a severe hip-disease rarely live to be over fifty years of age.

Death is due to complications in the vast majority of cases. The most common complications are tubercular meningitis, phthisis pulmonalis, and amyloid degenerations of internal organs. Early and efficient treatment undoubtedly lessens the mortality-rate by preventing complications. The length of time required to treat a case depends upon the time when the treatment begins and the severity of the case. Other things being equal, the earlier the treatment begins the better the result and the shorter the time required to bring it about ; but a certain number of cases will grow persistently worse, and develop complications under the best of treatment. When an abscess develops, the prognosis is not so good, although it does not render an excellent recovery impossible.

It usually requires from two to four years to bring about a favorable result in a well-marked case. Occasionally the time is shorter than two years, and not infrequently it is more than four years. Without treatment, the disease tends toward recovery, but with great deformity and ankylosis, and is apt to continue for from four to six years. In one case in which the writer performed amputation at the hip-joint successfully, the disease had continued for thirty-five years. The atrophy will never entirely disappear. The usefulness depends upon the amount of motion and the deformity. After mild cases the motion may be as great as in the well limb, but following severer cases, especially when suppuration has taken place, the motion is always reduced. The loss of motion varies from a hardly perceptible amount to complete ankylosis. Following suppuration there will be shortening. The amount of shortening varies from a small fraction of an inch to several inches. Shortening may occur without suppuration from interference with the growth center. The shortening may increase some, after complete recovery, from this same cause. Unless prevented by treatment, there will be great flexion, which causes practical shortening.

Treatment.—The treatment of hip-joint disease is constitutional and local. The constitutional treatment consists in building up the patient when he is run down and in meeting special indications. There is no special medication for the disease. Opiates are to be avoided. Good, nourishing diet and plenty of fresh air are of much greater importance than drugs.

The *local treatment* is either mechanical or operative. Mechanical treatment is applicable in the vast majority of cases. The great principle of treatment in this disease is rest, and the mechanism that carries out this principle best is the one that should be chosen. The best results are not to be obtained by applying exactly the same variety of brace or appliance to every case. The controversy between those who advocate traction and those who advocate fixation has been mentioned under the general head of Tubercular Arthritis, chapter xvi. Both methods have their place in the treatment of hip-joint disease. The great advantage in simple fixation is that it can be secured by simple means that are always at hand and that can be applied by comparatively inexperienced hands, while traction without confining the patient to bed can only be secured by special appliances that require special skill in their application.

While the majority of cases can be successfully treated by simple fixation, a certain number will continue to suffer pain and do badly until traction is applied. On the other hand, cases are occasionally met with that do better with fixation than with traction. The fact that the representatives of traction and of fixation each claim to have proven the superiority of their respective methods by statistics from their practice, simply shows that each has acquired special skill in the use of his favorite method, and has given the method credit which properly belongs to his skill. It is not in the interest of exact knowledge upon this subject for each party to compare his own results after his favorite method with his results after a method that he is prejudiced against. If the best results of representatives of each faction be compared, they will be found to be practically the same. The writer believes that a surgeon who is without prejudice in this matter, and who will select his cases for the respective methods, will secure the best average results.

When first called to a patient who is suffering severely and who has marked deformity, the surgeon can afford his patient the quickest and surest relief by putting him in bed and applying traction by means of weight and pulley. (For manner of applying weight and pulley, see directions for Buck's extension in any work on general surgery.) Picture-frame wire is very convenient for attaching the weight to the block. The amount of weight varies with the size of the patient and in different cases. When the patient is a child, half a brick is a good weight to begin with, and it is rarely necessary to apply more than two bricks to an adult, for it is not so much the amount of the traction as its persistency that overcomes spasm. A bag of sand is a very convenient weight, since it can be so easily made lighter or heavier, to meet indications. The amount of weight in a given case should be just what the surgeon finds will overcome the muscular spasm and relieve the pain ; too much weight will cause the patient more pain. The persistent tendency to slide to the foot of the bed can best be overcome by elevating the foot of the bed from two to four inches. Theoretically, the traction should be in line with the deformity, but, practically, the writer has found that it is rarely necessary to make any special provision for this, since the patient will place himself in bed in such a position as affords him the most relief and does him the most good. Two or three weeks in bed will usually be sufficient to relieve pain and overcome deformity. A child that has been suffering without proper treatment until it has become emaciated will often regain its flesh very rapidly under this treatment. The patient should be gotten out of bed as soon as possible, so that he can have the benefit of outdoor exercise. When the deformity yields promptly to the treatment in bed and the joint is not exceptionally sensitive, the chances are that a fixation apparatus will bring the case to a favorable termination. The writer usually applies plaster-of-Paris from just above the knee to the ribs (Fig. 129, A). This material is chosen

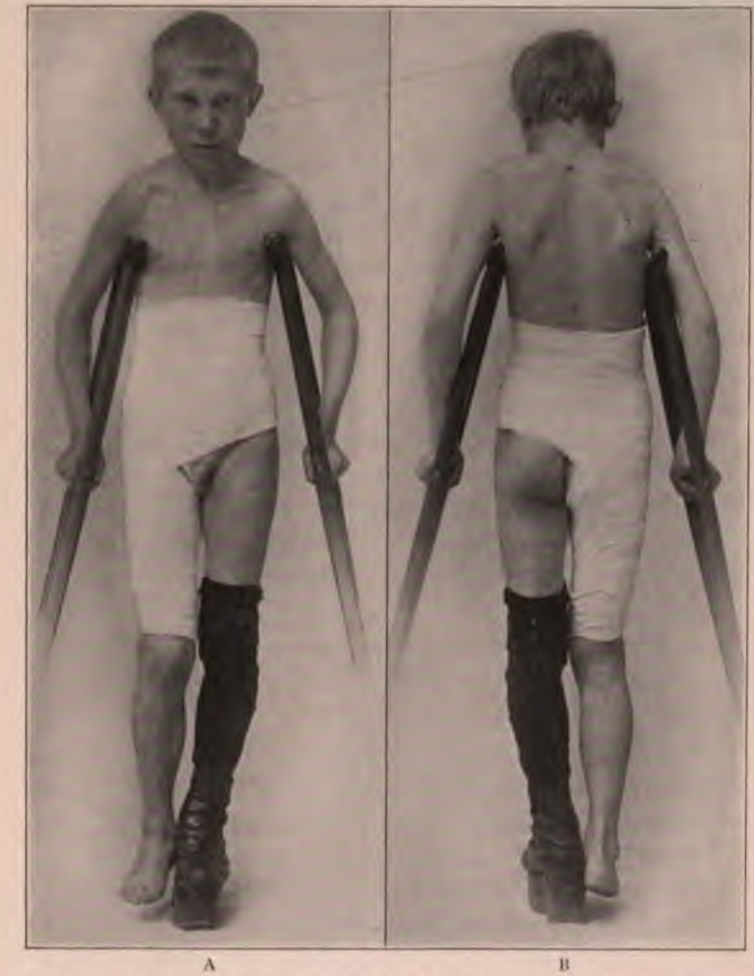
A B

Fig. 129.—A, plaster-of-Paris splint for hip-joint disease; B, back view, showing buttock covered.

because it is always at hand, and can be quickly and easily applied, and because it yields good results. It is a great boon in charity work because of its cheapness. The plaster should be applied over a close-fitting garment or a layer of bandage, and should be heavy enough to have the necessary strength without being a burden. It should be strengthened by small strips of wood running up and down over the fold of the groin. Care should be taken to cover the buttock well, because an open space in that locality will allow considerable motion at the joint. This is a very common error made in applying plaster, because, unless special care is exercised, the bandages will run so as to leave a V-shaped space in the cast just over the buttock (Fig. 129, B). Experience has taught the writer that it is rarely necessary to extend the plaster below the knee.

The shoe on the well side should be elevated from 2½ to 3½ inches, and a pair of crutches used; for if there is not plenty of elevation, the child will begin to use the afflicted limb as soon as weight upon it does not cause decided pain. The cheapest and best way to elevate the shoe is to have a block of light wood the shape of the sole of the shoe, and of the proper height, hollowed out so as to make it as light as possible, and fastened to the bottom of the shoe by screws coming through from the inside of the shoe. This block can be painted black, and can be made very presentable. If something finer is desired, a cork sole covered with leather is best.

Vance, of Louisville, recommends a splint made of sole-leather, which makes a very satisfactory appliance. Felt may be used instead of plaster. A pattern may be made of paper, after which the leather may be cut. It is then softened with cold water and molded to the patient's body by applying a roller-bandage over it. A better way, but one requiring much more work, is to make a plaster cast of the patient's body and mold the leather over this.

When applied to the body, the heat of the body will dry the leather in a very few hours. When the patient is too young to be kept quiet during the drying, a plaster-of-Paris bandage should be used in applying the leather, instead of a simple roller.* In England, the splint known as the Thomas hip-splint is used extensively, but is an extremely clumsy affair, and difficult to apply except by one who is specially skilled in its use (Fig. 130). The writer has used it and obtained good results, but considers it the poorest of all methods for the foregoing reasons. It consists of a bar of iron bent to fit the back and posterior surface of the limb from the lower end of the scapula to the lower end of the calf, and is held in place by cross-bars bent to fit the body and leg.

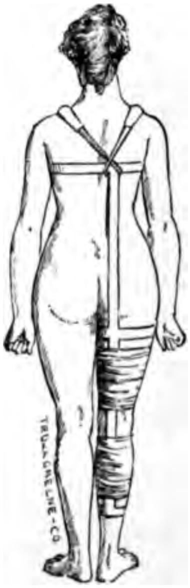

Fig. 130.—Thomas's hip-splint applied.

When the writer decides to use the fixation treatment in a given case, he usually applies the plaster cast to patients in all conditions of life. Among the poorer classes, this is re-applied as often as is necessary, and the results have been better than after any other treatment. Among the wealthier classes, the plaster is replaced by sole-leather or loop-leather. The leather can be lined with chamois, varnished, and have straps and buckles applied to take the place of the bandages. This makes a light and elegant appliance, and is apt to appeal to those oversensitive parents who are prejudiced against steel braces.

When a joint is exceptionally sensitive, or when the spasm returns as soon as the weight is removed, the writer has been better satisfied with one of the various traction appliances than with simple fixation. Occasionally a case will do badly under fixation which will yield promptly to traction.

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* What is known among harness-makers and artificial-limb makers as loop-leather is lighter than sole-leather, and holds its shape better. The writer has used it with great satisfaction.

Another very common indication for the long hip-splint, in the writer's experience, is the desire upon the part of the parent to have the most elaborate and most expensive appliance that can be obtained. The long hip-splint, which makes traction and allows the patient to walk about without the use of crutches, constitutes the "American plan" of treatment. It was first suggested by Davis, and has been ably advocated by such men as Taylor, Sayre, Shaffer, Gibney, and Bradford. Various slight modifications have been suggested, but the variety known as Taylor's hip-splint has proven most satisfactory in the writer's hand (Fig. 131). It consists of a steel waist-band and a long bar passing from the waist-band along the outer side of the limb to a point just below the sole of the shoe, where it bends inward at a right angle underneath the foot. To the waist-band are attached two perineal straps, upon which the patient sits as he walks. To the cross-piece underneath the foot are fastened two straps that pass up one on either side of the leg to buckles fastened to the side of the leg by adhesive plaster. In the long bar is a ratchet which enables the surgeon to lengthen or shorten the splint by means of a key. A limited amount of motion is allowed at the attachment between the waist-band and the upright, which allows of a better adjustment. The writer prefers a joint that can be locked when the brace is once properly adjusted, because the less motion at

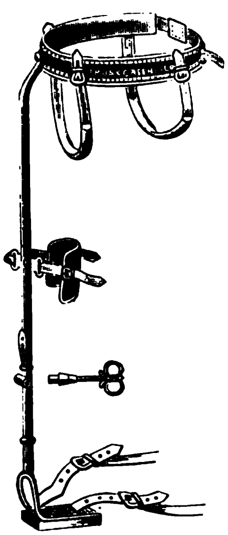

Fig. 131.—Taylor's long hip-splint.

this point the better. A strap is attached to the upright just opposite the knee, which passes around the knee to prevent motion.

In ordering a brace from an instrument-maker, give the circumference of the patient's body at the crest of the ilium, the distance from the crest of the ilium to the bottom of the foot, and state which side it is for. It is better to state that a Taylor's long hip-splint is wanted, since various modifications are in the market that are not desirable.

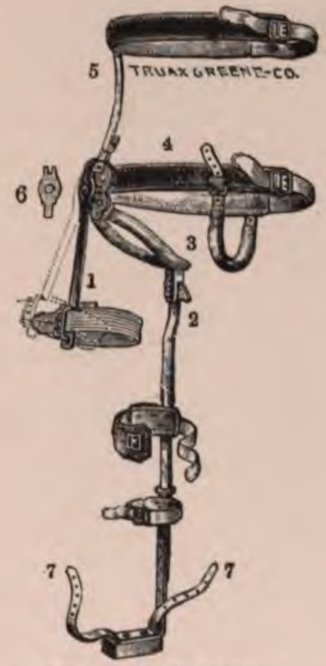

Fig. 132.—Phelps' hip-splint.

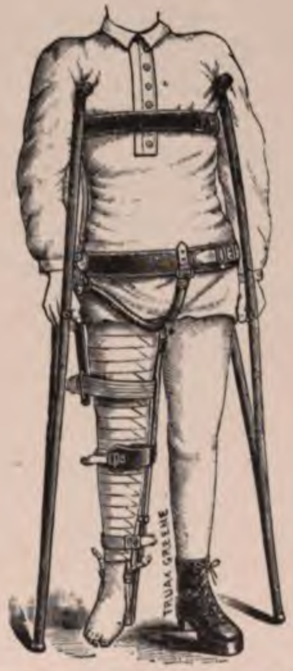

Fig. 133.—Phelps' hip-splint applied.

Dr. A. M. Phelps has invented a splint which combines all of the features of the Taylor and the Thomas splints and provides for lateral traction as well (Figs. 132 and 133). The use of the lateral traction is to pull the head of the femur away from the acetabulum and thus lessen the pressure upon the diseased parts. The splint is an excellent one, and will, when properly managed, yield good results; but for one who is not skilled in the use of mechanical appliances it is too elaborate. Theoretically, lateral traction is correct, but practically it has not been found necessary.

To apply a Taylor brace, the patient should be placed upon his back upon a table, and two strips of adhesive plaster, with buckles firmly sewed to the lower end, applied, one on either side of the leg, beginning well up on the thigh and ending with the buckles just above the malleoli. The plasters are held in place by a roller-bandage snugly applied. The waist-band is first buckled around the pelvis between the crest of the ilium and the trochanter. The perineal straps are next buckled so that the waist-band cannot get above the crest of the ilium and not so short as to draw it down over the trochanters. The most common error is in buckling the perineal straps so loose that the waist-band is allowed to go clear above the pelvis, where it cannot get the proper hold upon the body. The straps attached to the foot-piece are now fastened to the buckles attached to the limb. The brace is now lengthened by means of the key until the perineal straps and the straps below are on the stretch, thus keeping up a constant pull which overcomes the muscular spasm. The foot-piece must be so adjusted that when the patient steps upon the brace the foot will swing clear and not touch the foot-piece or the floor. No matter how much pull there is, if the foot swings so close to the cross-piece as to touch it when the patient steps upon it, the joint is not protected. This instrument, when properly applied, will keep a constant gentle pull upon the joint, and, when the patient steps upon it, will support the weight of the body entirely upon the perineal straps (Figs. 134 and 135).

The amount of traction does not need to be great, because it is not the strong traction but the continuous traction that affords the most relief. The amount of traction in a given case can usually be decided by the relief from spasm and pain. Too heavy traction becomes unbearable, and too little allows muscular spasm.

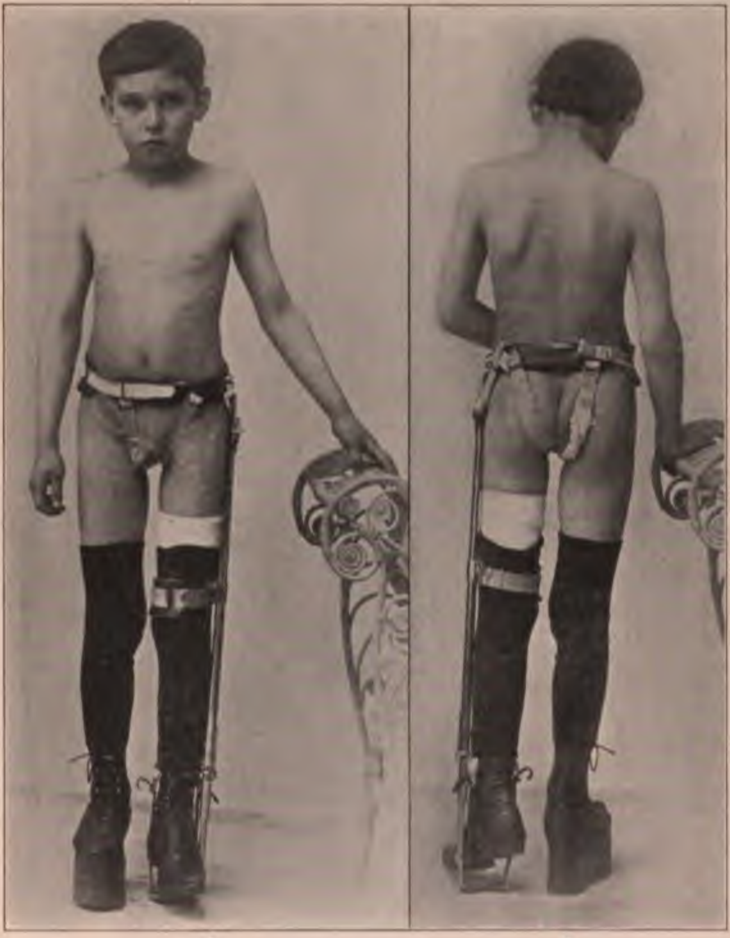
A B

Fig. 134.—Taylor's long hip-splint applied. A, front view; B, back view.

When a patient first begins to wear a brace, great care should be taken to keep the straps and the perineum clean and dry, for fear of irritation to the skin. It is well to have more than one pair of straps, and they are best made of heavy webbing and covered with several layers of Canton flannel, so that they can be washed. After the patient has become accustomed to the brace, very little trouble is to be expected from the straps.

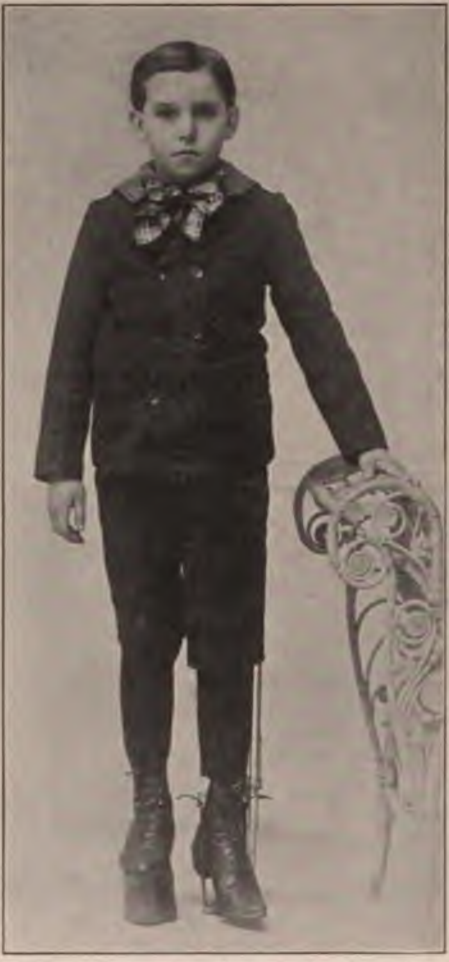

Fig. 135.—Patient dressed, wearing long hip-splint.

In very delicate-skinned persons, the adhesive straps need to be changed quite frequently in order to prevent the skin from becoming sore. If the skin is found to be broken in spots, it should be thoroughly covered with a dusting powder, after a careful washing with soap and water, and the new plaster applied over the powder. Calomel is a favorite powder with the writer. With an average patient, the plasters will need changing every four or six weeks. For patients from a long distance the writer has had plasters render good service for four months. As a rule, the patient can walk upon this brace without assistance, but occasionally a very delicate or sensitive patient will require crutches as well.

An objection raised to the long spint is that it confines the knee and may destroy it by depriving it of motion for so long a time. Experience has proven that it does not injure a healthy joint to keep it quiet. When ankylosis occurs in a joint after confinement, it is due to the disease present and not to the rest.

When the patient has been entirely free from pain and spasm for four or six months, the brace may be removed, and a trial made to use the limb. If there is some motion, which gradually increases with use, the joint is probably well. Should pain and spasm return, the brace must be re-applied at once. It should be remembered that exacerbations occur in this disease, even when the case is progressing favorably, but as the case improves they are fewer, and farther apart.

The complications have been spoken of in detail under the head of Tubercular Arthritis. The most frequent one in hip disease is abscess, and it is to be treated according to rules laid down in the above-mentioned chapter.

Operative treatment will be required in a small percentage of cases of hip-joint disease. The condition most frequently demanding operation is abscess, for the treatment of which see chapter xvi. In properly selected cases operative measures are truly conservative.

Arthrectomy is not applicable to this joint, but excision is a very satisfactory operation in properly selected cases.

Excision of the hip is not to be performed until it is evident that mechanical treatment will fail. At one time, a few years ago, it was thought proper to remove the head of the femur as soon as the diagnosis was clearly established, but experience gained at that time has taught us that this heroic treatment does not yield as good ultimate results as more conservative treatment. Some surgeons claim that the formation of an abscess is sufficient cause for excision, but this the writer does not believe, for many cases are brought to a satisfactory termination by mechanical methods notwithstanding the presence of abscess.

Excision of the hip is indicated as soon as it is evident that mechanical methods are going to fail, when numerous sinuses exist showing so great an extent of disease that the time required to obtain a result from mechanical treatment will be too long, and when it is evident that a large sequestrum exists. In certain cases coming under the surgeon's care at a late date, where the deformity is great, excision will often yield better results than mechanical treatment. This operation is not a very dangerous one, and may be indicated in certain cases in which the general health is rapidly failing, as a life-saving measure.

Many older writers place the mortality-rate of excision of the hip at 30 per cent., but with modern methods it should be less than ten per cent. With a constant mortality-rate of 30 per cent., the operation could not be looked upon as a life-saving measure, for Gibney reports a series of 80 cases treated expectantly (that is, without mechanical or operative measures) with a mortality-rate of only 12½ per cent.

In the writer's experience, the operation *per se* is not very dangerous. The high mortality-rate given by older writers is largely due to the fact that they charged every death occurring in a person upon whom excision had been performed to the operation, which is evidently unfair, because the operation is naturally performed upon bad cases, a large number of which would die without an operation. The modern operation, when performed for indications as previously stated, is certainly a life-saving measure, because fewer cases die with it than without it.

The number of cases dying from the immediate effects of the operation is very small indeed, but unfortunately, in a certain number of cases, a general dissemination of tuberculosis follows operative interference. This, however, does not occur as frequently as is generally believed.

When comparisons are made between the results following mechanical treatment and those following operative treatment, it should be remembered that the cases operated upon were naturally much worse cases than the others, and therefore necessarily yield less satisfactory results.

The immediate results of excision are very satisfactory, but the remote results are not nearly so good. Every operator has seen a poor, emaciated, bed-ridden sufferer changed in a few weeks to a fat, healthy child by the operation ; unfortunately, however, relapses are quite frequent, and it is rarely, indeed, that secondary scrapings and overhaulings are not required. The immediate shortening following excision of the hip is less than one would naturally expect, and if it did not gradually increase, the functional results would usually be quite satisfactory ; but, owing to the fact that one center of growth is removed, this limb does not grow so rapidly as the other one, and the shortening gradually increases. The operation should be performed as a life-saving measure, in which case a shortened limb is of comparatively little consequence. Occasionally a flail joint follows excision, but this is rare.

The accompanying illustrations, showing extension, flexion, and rotation, were taken from photographs of very satisfactory results.

One case (see Figs. 136 and 137) was a boy of six years, who had a well-developed hip disease when he came under the writer's care, and soon developed an abscess. The treatment was a plaster cast from just above the knee to a point well up on the ribs, an elevated shoe on the well side, and crutches (see Fig. 129). The abscess was not large,

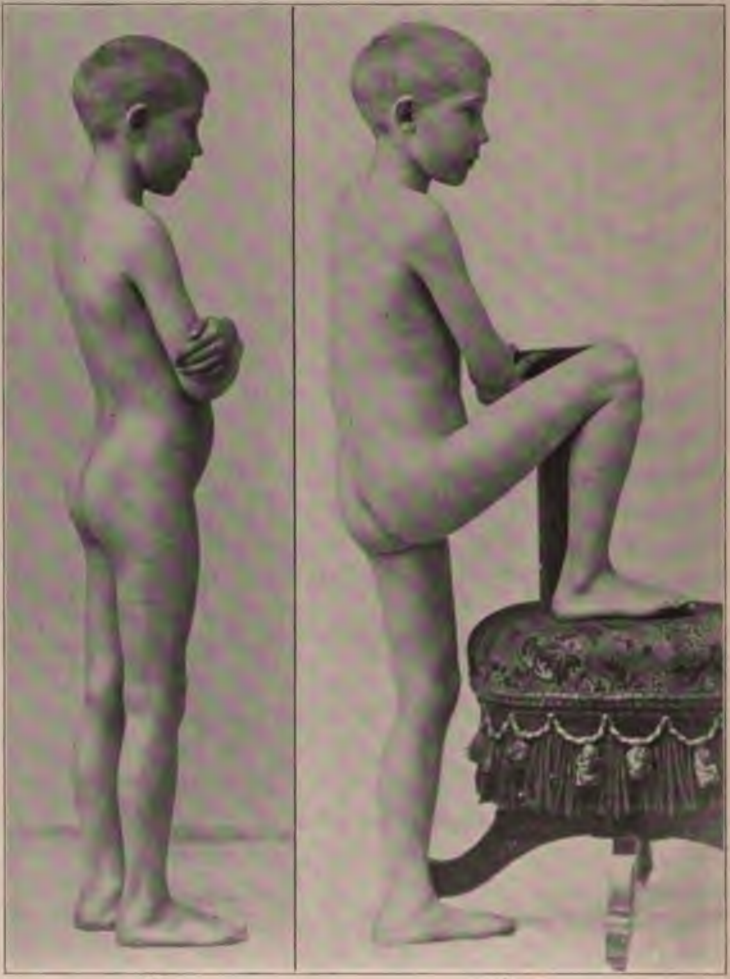
A B

Fig. 136.—A, showing result from rest-treatment; B, showing amount of flexion.

and was not interfered with; it gradually grew smaller, until nothing remained but a small nodule. After mechanical treatment had been discontinued for some time, this nodule or cheesy focus began to enlarge. An incision was made and the whole sac removed. The wound was closed and dressed aseptically, and union under one dressing followed, since which there has been no trouble. The whole

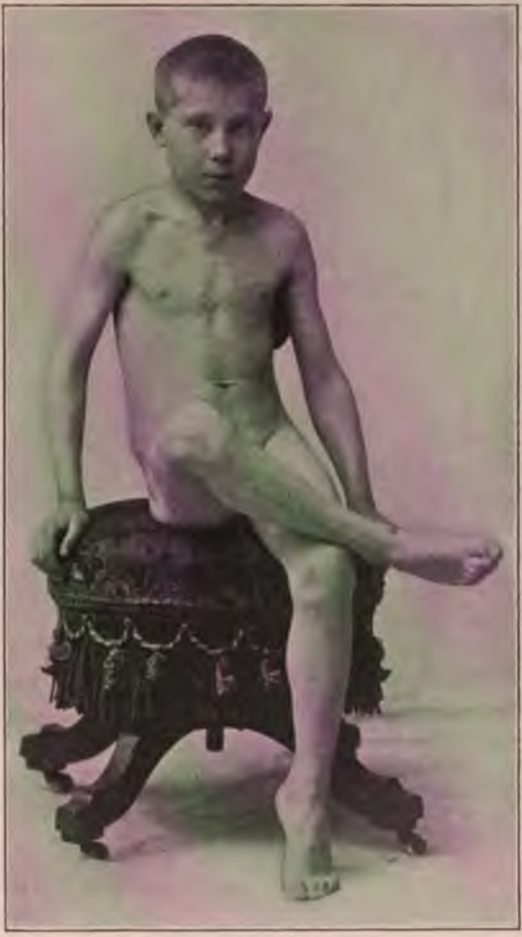

Fig. 137.—Showing rotation.

treatment extended over two and one-half years. There is no perceptible shortening, and motion is nearly perfect.

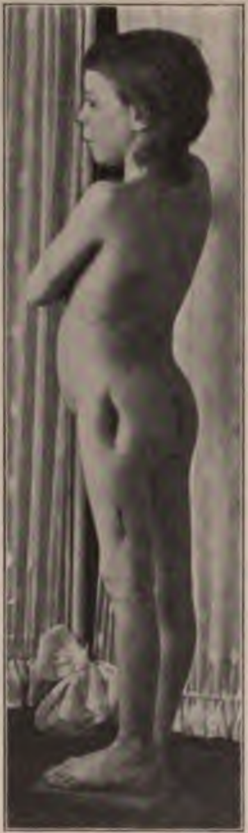

Fig. 138.—Showing result after excision.

Another case (see Figs. 138 and 139) was a girl of seven, upon whom the writer performed excision on account of abscess and separation of the head of the femur. The present amount of shortening is only ½ of an inch, and the functional result is very satisfactory, but of course the amount of shortening is liable to increase as she grows older.* It was necessary to overhaul the wound and scrape it out several times before it finally closed. The patient was out of bed three months after the operation, and began to walk soon afterward.

These two cases were chosen for comparison, each being from among the very best results from the respective methods of treatment in the writer's experience. The boy's case, treated mechanically, shows a better immediate result, as it should, because his was not nearly so bad a case as the other one. Had the girl's case been treated by mechanical means, the chances are she would not have recovered; or, if she had, it would have been after prolonged suffering and with bad deformity. Of course, a better immediate result could be obtained by early operation, but the consensus of opinion in America is that it is not justifiable, on account of the subsequent shortening (Fig. 140).

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* The trochanters were not removed, which accounts for the small amount of shortening.

Dr. Lewis A. Sayre recently exhibited before the American Surgical Association a case upon which he operated in 1854, together with others operated upon along in the "sixties" and "seventies." The first case is believed to be the first successfully operated upon in America, and is certainly one to be proud of.

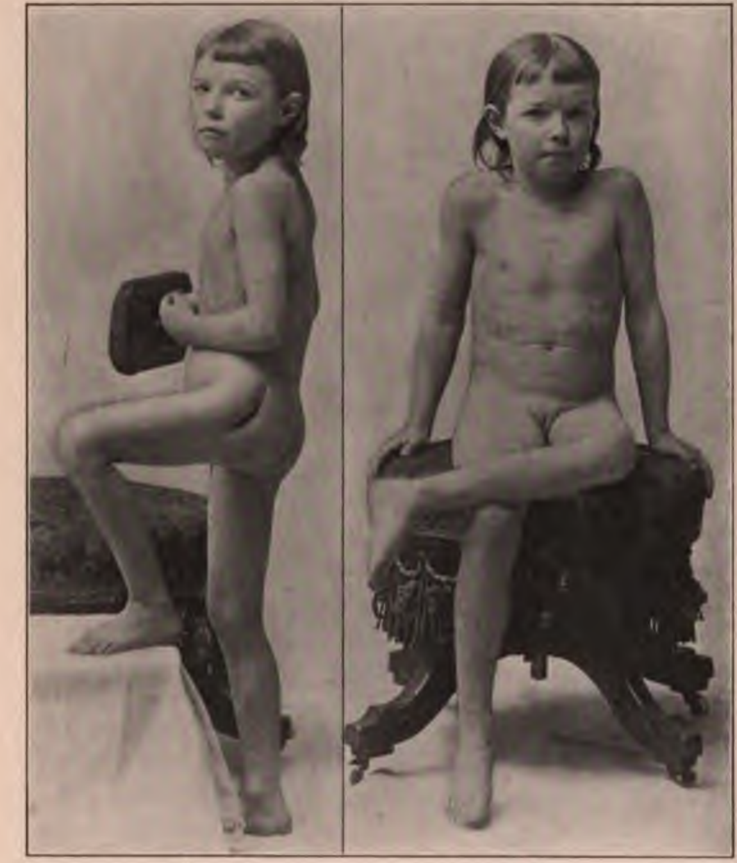
A B

Fig. 139.—A, showing amount of flexion; B, showing amount of rotation.

The best known incision for excision of the hip is the straight incision of Langenbeck (Fig. 141). It is made with the thigh flexed to an angle of 45 degrees. It begins well up toward the posterior superior spine of the ilium, and passes down over the apex of the great trochanter, along the outer side of the femur. The posterior or curved incision, as recommended by Sayre, White, and others, is a very good one, affording good drainage and ready access to the joint (Fig. 142).

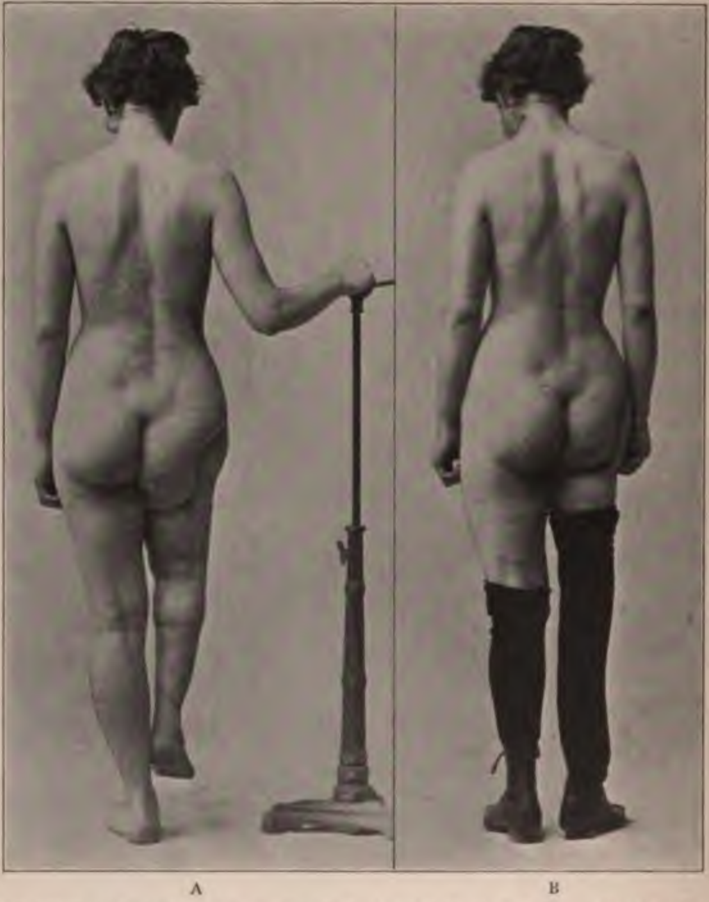
A B

Fig. 140.—A, showing shortening ten years after excision, in what was considered a very good case; B, prosthetic appliance to correct shortening.

To perform this operation, the patient should be placed upon the well side and the incision boldly made down into the joint. The hemorrhage is never serious, and can be quickly controlled. Much stress has been placed upon the importance of saving the periosteum, but it is frequently diseased, and should be removed, together with all other diseased tissues. The majority of cases requiring operation demand the removal of all of the bone above the lesser trochanter. In cases demanding operation for the removal of the separated epiphysis, it may be possible to save the remainder of the bone. When extensive removal of bone is required, all muscular attachments must be severed from the trochanter, and the bone sawn through below the diseased point. It is generally recommended to dislocate the head of the bone by forcible adduction and rotation outward before cutting it off, but sometimes it will be found rather difficult to accomplish this, and it will then be easier and safer to cut through the shaft with a chain saw or osteotome, after which the head can readily be removed with forceps and scissors. The writer has known the shaft

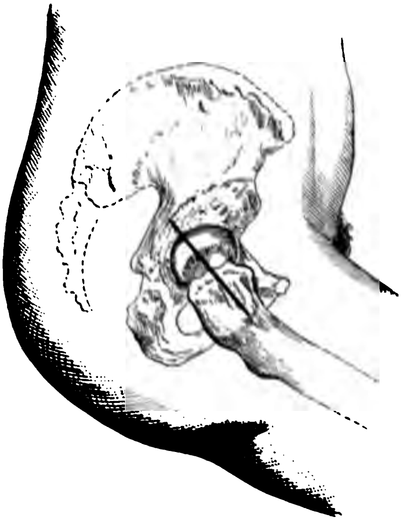

Fig. 141.—Excision of the hip (Langenbeck's external incision).

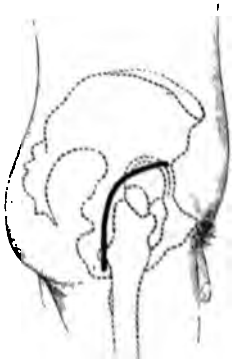

Fig. 142.—Excision of the hip-joint (Tillmanns).

of the femur to be broken during efforts at dislocation. The acetabulum must be carefully examined, and all dead bone or diseased tissue removed. In the majority of cases, only soft tissue will be found, which can best be removed with a Volkmann's spoon (Fig. 143). When all diseased tissue has been removed, the wound should be thoroughly washed out with a bichlorid solution. The wound should be partly closed with silk-worm 'gut sutures, packed with iodoform gauze, and a dressing of sterilized gauze and cotton applied.

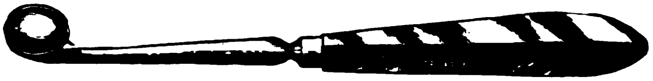

Fig. 143.—Volkmann's spoon.

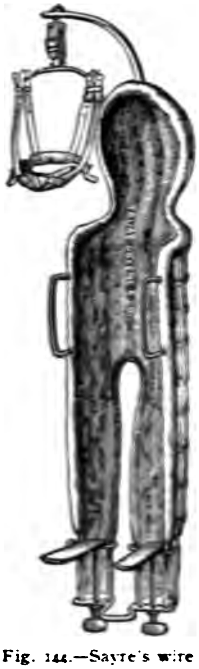

Fig. 144.—Sayre's wire cuirass.

The best and most convenient appliance after operation is Sayre's wire cuirass, but it is not always at hand (Fig. 144). Extension by weight and pulley is a very satisfactory method. The writer has also used a fenestrated plaster cast with perfect satisfaction. The first dressing should be changed about the fourth day, unless especially indicated sooner. It must not be left too long or the removal of the packing will cause great pain. The writer's experience is that irrigation of the wound with bichlorid solution at each dressing does more harm than good. If the wound is quite dry, as it should be if all diseased tissue has been removed, it is far better to repack without irrigation. If there is a profuse discharge, sterilized water or normal salt solution is better than bichlorid, because the latter is injurious to the granulations.

From the brilliant results reported by some of our English brethren, some time ago, we hoped to be able to close up the wound and secure union as in knee excisions, but we have been disappointed. The wound usually closes in from four to six weeks in favorable cases. In many cases it becomes tubercular and requires a thorough curetting. It is a wise plan to apply a long hip-splint after excision, and allow the patient to wear it for six months or a year, to give the new joint time to gain strength. In the majority of the writer's cases the patient has been kept in bed for from six weeks to three months with a weight and pulley attached, after which he was allowed to go about on crutches without any apparatus, and results have been satisfactory. The patient should not be encouraged to walk upon the new joint too soon.

Hip Disease in Adults.—It has been the writer's misfortune to meet with quite a number of cases of hip-joint disease in adults, and he has found their management a far more difficult problem than in childhood. The prognosis in this, as in other tubercular joint-affections in adults, is not nearly so good as in children. The disease is apt to continue for a long time at best, and is very prone to end with phthisis.

Treatment with the long splint is not very satisfactory; when it is employed, crutches are required, on account of the weight of the patient. The Thomas splint has been used by the writer for adults more than for children. Of late, when these cases have failed to show improvement within a reasonable time, excision has been resorted to, with far better average results than from any other treatment. The number of cases is yet too small, and the time too short, to admit of any definite conclusions, beyond the facts that the operation has not been dangerous, and immediate results have been quite encouraging.

Double hip-joint disease occurs occasionally, usually beginning in the second joint while the first one is under treatment. The second one is usually comparatively mild, probably because the patient is necessarily quiet. The treatment is rest in bed, with extension by weight and pulley.

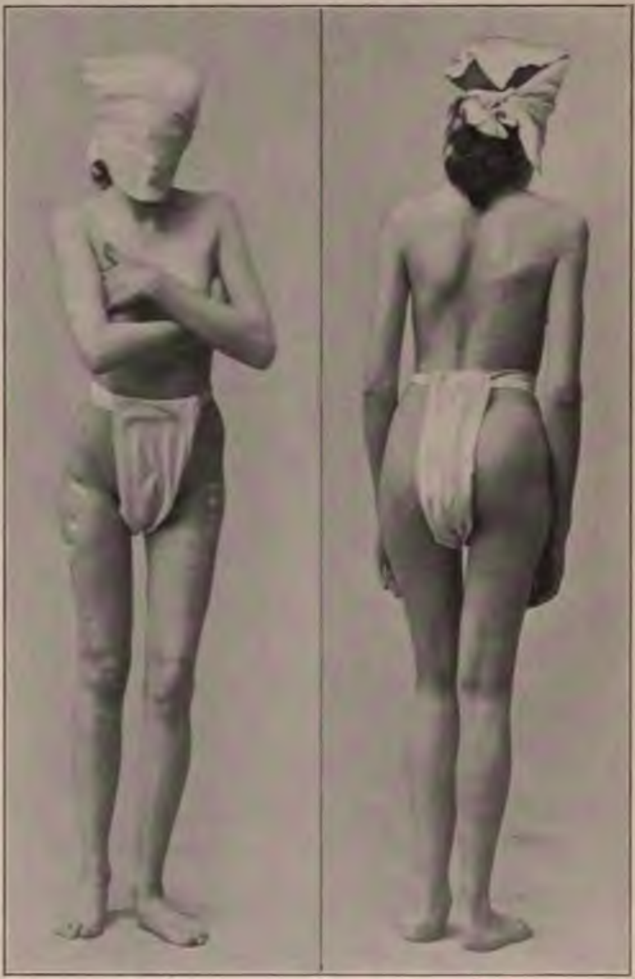

Fig. 145.—Double hip-joint disease. A, front view; B, back view.

Figure 145 shows the result after double hip-joint disease. The case came under the writer's care when the second hip was far advanced and the legs crossed. After the disease was cured on both sides, tenotomies were performed on the right side and the flexion and adduction overcome by force. On the left side an osteotomy was performed below the trochanters and the limb straightened. The patient is now able to walk a long distance.

CHAPTER XVIII.

SACRO-ILIAC DISEASE (SACROCOXITIS).

This is a tubercular inflammation of the sacro-iliac joint, and is a comparatively rare disease, but probably not nearly so rare as is generally believed, because it is frequently overlooked.

The sacro-iliac joint may be the seat of acute suppurative and other inflammations, but in the vast majority of cases it is tubercular.

It was first described by Boyer in 1821, but has attracted very little attention until within a few years. It is essentially a disease of young adult life, although it may occur at any time of life, and is slightly more frequent in males than in females. Its causes and pathology do not differ from those of any other tubercular arthritis.

Symptoms.—Lameness and pain are always present in this disease, beginning at an early stage. The patient walks carefully and favors the affected side as much as possible. When standing, he leans toward the well side, relieving the affected side of as much weight as possible. This attitude, when standing, is quite characteristic (Fig. 146). There is apparent lengthening of the limb on the affected side, due to the tilting of the pelvis. Local swelling and rise of temperature may be present. The patient is very liable to become bed-ridden, when he will lie upon the well side.

Abscess occurs in the majority of cases, and may be either intra- or extrapelvic, usually the former, when it can often be felt by vaginal or rectal examination.

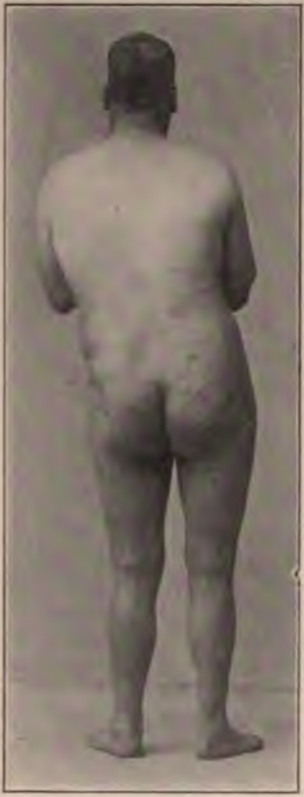

Fig. 146.—Sacro iliac disease (right side).

The pain usually radiates along the sciatic nerve, and may be most marked as far away as the knee. It may be very severe in the rectum or bladder. At first the pain is apt to be intermittent and not very severe, but later it is constant and severe. Pressing the sides of the pelvis together elicits pain at the joint. This is a pathognomonic symptom. There is apt to be local tenderness over the joint. Owing to the fact that this is practically an immovable joint, the muscular spasm so characteristic in other joints is absent in this disease, but slight atrophy is present on the affected side.

This disease is probably always diagnosticated as sciatica at first, owing to the fact that the pain is propagated along the sciatic nerve. In every persistent case of sciatica, therefore, sacro-iliac disease should be excluded by careful examination. It is also liable to be mistaken for Pott's disease, hip disease, or lumbago.

When pain in the joint can be produced by crowding the two sides of the pelvis together, this is almost sufficient evidence for a diagnosis, because in no other disease is this symptom present. If, with this symptom, the peculiar attitude previously described is assumed and swelling is present in the region of the joint, the diagnosis is clear. In sciatica, the foregoing symptoms do not exist. In lumbago, the pain is bilateral, and is higher up.

At a very early stage it is practically impossible to make a differential diagnosis between this disease and Pott's disease in the lower lumbar region. If the patient is a child, the probabilities are that it is Pott's disease. In Pott's disease the attitude will be different and the spine will be rigid. There should be no difficulty in making the differential diagnosis between this disease and hip-joint disease, for in the former motion in the hip-joint is free, and in the latter it is restricted.

Prognosis.—The prognosis in this disease is always grave, and where abscess exists it is very grave indeed. Of 38 suppurative cases reported by van Hook, only three recovered.

Treatment.—The principles of treatment are the same in this as in any other tubercular arthritis—viz., rest and protection. The pelvis should be surrounded by a band of plaster-of-Paris or of adhesive plaster, a high shoe applied to the well foot, and crutches used. When the patient is bed-ridden, the band should be applied around the pelvis, and a weight applied, as for a broken femur.

Weller van Hook * and Hektoen † have reported a number of cases operated upon with results that can be considered as an improvement upon non-operative treatment in suppurative cases.

When the swelling is external, an opening should be made directly over it in the line of the joint, and the diseased tissues thoroughly removed with chisel and scoop.

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* *Annals of Surgery*, vol. viii.

† *North American Practitioner*, 1890.

When the abscess is internal, van Hook recommends that an opening be chiseled through the ilium, above the joint, and access gained to it in this way.

The cavity should be thoroughly irrigated with a bichlorid solution, and drained with iodoform gauze, after which a large surgical dressing should be applied.

When the abscess is found projecting into the vagina, it should be opened and drained in that direction, but it is hardly to be expected that the case will get well without a direct opening and cleaning out of the joint.

CHAPTER XIX.

DISEASE OF THE KNEE-JOINT.

Tuberculosis of the knee is known by a variety of names, the most common of which are "white swelling of the knee," "tumor albus," and "fungous synovitis of the knee." It is most frequent in children, in whom it usually begins as an osteitis. The causes and pathology have been discussed under the head of Tubercular Arthritis, to which the reader is referred (chap. xvi). This joint, being superficial, is more liable to injury and exposure to cold than the hip. It is believed that a larger percentage begin as a synovitis in this than in the hip-joint.

Symptoms.—This is a chronic disease, and the beginning is usually insidious. The child will complain of pain, and the joint will be stiff and lame. The pain at first, as a rule, is not severe, but is apt to be worse at night.

When the disease is somewhat advanced, exacerbations occur, during which the pain is very severe. Local tenderness is well marked. As a rule, the most sensitive spot is over the inner condyle. The limp, which appears early, is due to tenderness, and to stiffness caused by muscular spasm. It is in this joint that the white appearance peculiar to tuberculosis is best marked; hence the name "white swelling." This peculiar color, together with the swelling of the joint with atrophy above and below, present a picture that cannot well be mistaken for anything else (Fig. 147). There is a local rise of temperature that can readily be detected by comparing the two knees. At an early stage, before the peculiar color has developed, and when the patient complains of soreness and stiffness, which is worse when he first begins to walk in the morning, this disease is very frequently mistaken for rheumatism.

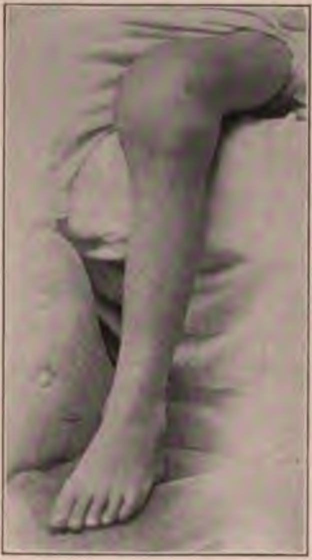

Fig. 147.—Tubercular knee.

In this, as in hip-joint disease, limitation of motion, due to muscular spasm, is one of the earliest and most unmistakable symptoms. Later, contraction of the hamstring muscles causes flexion, and subluxation backward of the tibia (Fig. 148). Night-cries, so characteristic of tubercular arthritis, appear in this disease less frequently than in hip disease; they occur usually as the child is going to sleep, and are probably due to alternate relaxing and spasm of the muscles.

When the disease is well advanced, lateral motion may be present, owing to destruction of the lateral ligaments.

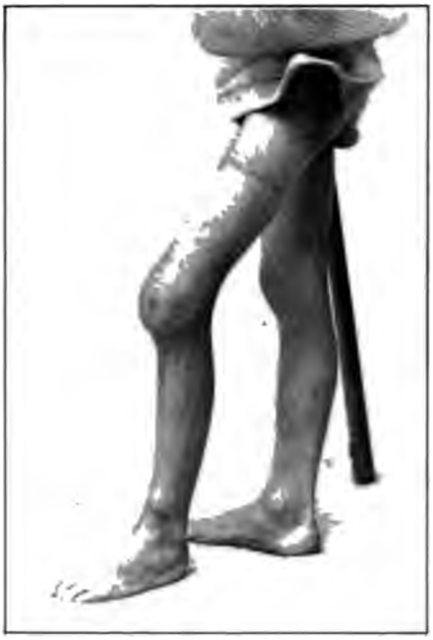

Fig. 148.—Showing flexion and subluxation of tibia backward.

Crepitation may sometimes be present, but should never be sought for.

Abscesses occur quite frequently in knee-joint disease, and usually approach the surface on the inner side, although they may appear at other points.

With these well-marked local symptoms, the general health is not greatly affected except in the later stages of bad cases or during severe exacerbations. Patients coming under the surgeon's care at a late date may be greatly emaciated from prolonged suffering alone, so that when the suffering is relieved they will rapidly gain flesh and strength.

Diagnosis.—After the disease is well advanced, the appearance is so characteristic that the diagnosis offers very little difficulty, but it is important to make an early diagnosis in order to obtain the best results from treatment.

Frequently recurring pain in a child's knee-joint, accompanied by lameness, should lead to a careful examination. It should be remembered that in beginning hip-joint disease the pain complained of may be in the knee. In examining an affected knee, it should be compared with the well one. Sometimes a local rise of temperature may be detected at quite an early period by a very delicate hand. Swelling can be first detected on either side of the patella. The joint loses its expression, as it were. The natural depressions are filled up, and the bony prominences are not so well marked. Careful measurement of both extremities should be made. Atrophy above and below the knee begins quite early. Slight flexion is also an early symptom. In this disease, however, as in hip-joint disease, limitation of motion and muscular spasm are the most reliable symptoms upon which to base an early diagnosis. Gentle passive motion should be made, first upon the well side, to gain the patient's confidence and to gage the amount of normal resistance. Next, the suspected joint should be gently flexed and extended. When tuberculosis is present, motion will be slightly interfered with, and spasmodic jerking of the muscles will be felt, even at a very early period.

Prognosis.—The tendency of this disease, *when untreated*, is to gradually extend to all tissues of the joint, doing them more or less permanent injury. The swelling becomes very marked, and abscesses form. There will always be flexion, and often subluxation of the tibia backward. Notwithstanding this train of grave symptoms, the tendency is eventually toward recovery. The swelling will subside, the abscess discharge, the sinuses heal, and the disease disappear, leaving an atrophied, scarred joint, ankylosed in a position of marked deformity. This disease does not destroy life itself, but is accompanied by quite a large mortality-rate from complications, such as tubercular meningitis, pulmonary tuberculosis, and amyloid degenerations. Fortunately, this course may be so favorably modified by proper treatment that the prognosis as to life and usefulness of the joint is much better then would be expected; in fact, it may be said to be fairly good.

This is a very chronic disease, continuing from one to several years, even under good treatment, and quick results are not to be expected.

Treatment.—The constitutional treatment has been sufficiently dwelt upon under Tubercular Arthritis. Local treatment, although very popular with the laity, is of no value as a curative measure. Heat is a valuable agent when pain is severe, and can be best applied by means of hot-water bags. Poultices have no value beyond the moist heat which they produce, and are inconvenient and untidy. Chloroform liniment seems to be of value at times, but any other liniment will answer the same purpose, for the effect is due to suggestion rather than to real medicinal properties. It is not in the patient's interest for the surgeon to be too positive in his statements that liniments and other popular local applications are of no value, because the feeling they give the patient that something is being done for him helps both the patient and surgeon. It is the writer's practice to allow local applications when they in no way interfere with the mechanical treatment.

The prime indications in the treatment of this disease are rest and protection, and, owing to the favorable location of the joint, they are comparatively easy to meet. When first called to a case, during an acute exacerbation, the writer has secured the most satisfactory results from rest in bed and traction by means of weight and pulley. It will rarely be necessary to confine the patient to the bed for more than three or four weeks, and during that time he is likely to gain in flesh and appetite because of the relief from pain. Occasionally, a case will occur in which the disease is very painful, and grows persistently worse in spite of every form of treatment. In such a case confinement in bed is unavoidable. The amount of weight required varies with the age of the patient—from half a brick to two bricks. Just as soon as the pain is sufficiently relieved, some variety of fixation apparatus should be applied, and the patient allowed to go out of doors.

If a case is mild when first brought to the surgeon, confinement to bed is not necessary, but a fixation apparatus should be applied at once and the joint protected. By protection we mean that some apparatus shall be applied so that he cannot bear weight upon the joint. It is the writer's practice to apply a plaster cast in every case at first, no matter what variety of apparatus he may intend to apply later, because it is always at hand and no time is lost. It is of very little value to apply a cast and allow the patient to walk upon the diseased limb. He should have the shoe on the well side elevated from 2½ to 4 inches, and use crutches. The shoe can be elevated by means of a block of light wood cut the shape of the sole, and hollowed out so as to make it as light as possible. This, when painted black, is very presentable. When the patient wishes something finer, he can have a cork-soled shoe made.

The plaster should be applied from just above the malleoli well up to the body (Fig. 149, A). It is a mistake to apply it only part way up the thigh, because this will not prevent motion at the knee-joint (Fig. 149, B). The writer treats all of his charity patients, and a good many of his pay patients, with plaster-of-Paris, an elevated shoe on the well side, and crutches, and the results are just as good as by any other method.

The joint can be very satisfactorily fixed by using a long posterior splint, properly fitted and held in place by means of a roller-bandage. The best fixation apparatus for treating knee-joint disease is Thomas' knee-splint (Fig. 150). It can also be used in cases requiring traction. It consists of a padded iron ring, which surrounds the thigh at the perineum, and to which are attached two iron rods extending to an iron plate or ring below the sole. The upper ring is attached to the rods at an angle of 55 degrees, and surrounds the thigh, so that when the inner side of the ring rests upon the perineum the outer side passes half-way between the crest of the ilium and the great trochanter. In measuring for the ring, allowance must be made for liberal padding. The measurement for the inner upright must be from the perineum to a point three inches below the sole,

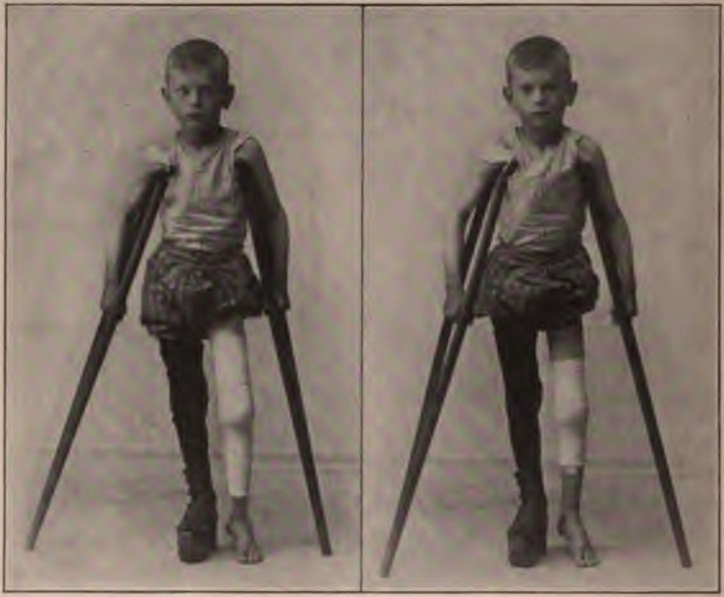
A B

Fig. 149.—A, plaster cast properly applied to knee; B, plaster cast improperly applied to knee.

and for the outer one, from a point half-way between the crest of the ilium and the great trochanter to a point three inches below the sole.

The brace is applied by passing the leg through the ring until the latter rests against the perineum. The apparatus is suspended from the opposite shoulder by means of webbing attached to the ring before and behind. The limb is fixed by means of a roller-bandage or lacings. The shoe on the well side is elevated so as to bring the sole on that side level with the lower end of the brace (Fig. 151). An active child will walk very easily with this brace without crutches. When he steps with the diseased limb he sits upon the ring, and no weight is thrown upon the diseased joint. This splint was invented by the late Dr. Thomas, of Liverpool, to secure both fixation and protection, but the writer

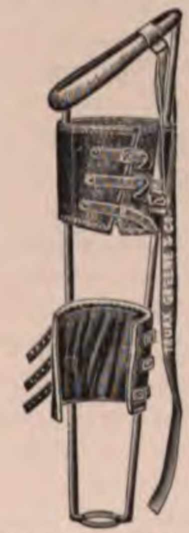

Fig. 150.—Thomas's knee-splint.

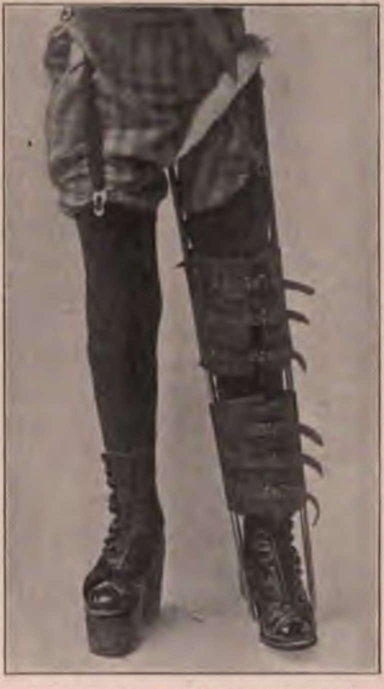

Fig. 151.—Thomas's knee-splint applied.

has very often applied both a light plaster cast and a Thomas splint, depending upon the plaster for fixation and upon the splint for protection, and has been greatly pleased with the combination.

Except in severe cases that are best treated by weight and pulley, the writer has seldom found traction necessary in the treatment of knee-joint disease. When it is necessary, the Thomas splint answers the purpose admirably. Buckles are fastened to either side of the leg by adhesive plaster, and traction is made by buckling these to straps attached to the foot-piece of the brace.

The complications met with requiring special treatment are deformity and abscess. Abscesses occur in quite a large percentage of knee cases. They usually appear at the outer side and below the patella, but may appear at almost any point, even in the popliteal space. Their treatment has been sufficiently dwelt upon under Tubercular Arthritis.

Deformity begins as flexion, and later has added subluxation backward of the tibia, with a slight rotation outward of the tibia upon its long axis. The flexion is produced partly by the contraction of the hamstring muscles, and partly by enlargement of the epiphyses of the femur and tibia. In cases requiring the weight and pulley, this is usually sufficient to overcome the deformity. When the surgeon is called before the disease is far advanced, the slight deformity is usually overcome by the measures employed to secure fixation. When plaster-of-Paris is applied in such a case, it is not necessary or advisable to apply force to overcome the deformity as the plaster sets. The limb should be placed in the best position possible, without using force, and when the cast is removed, ten days or two weeks later, it will be found that the deformity is not so great as when the cast was applied. In such a case, when the patient lives at a distance from the surgeon, so that the plaster cannot be changed often, he should be given an anesthetic and the joint straightened at once. Straightening slowly by leverage is not to be recommended. The writer wishes to be distinctly understood as advocating the straightening of a tubercular knee by force only under favorable conditions; it would be a very dangerous proceeding in many cases. When the disease is active or sinuses are present, this procedure is positively contra-indicated.

When pain and spasm have been entirely absent for four or six months, a trial may be made without the brace. If the arc of motion increases, and there is no return of spasm, the joint may be considered cured, and the appliance left off. If, however, there is the least return of spasm, it should be reapplied. A certain amount of swelling is to be expected after removal of the brace, even when the joint is perfectly well. It is very important to keep watch over the patient when convalescing, lest he bear weight upon the limb too soon. He will do this as soon as he finds that it does not hurt him, unless the apparatus is so arranged that he cannot.

When the joint becomes disorganized, or when, in spite of proper treatment, the joint grows persistently worse, operative procedures are to be considered. In this, as in other joints, a time may arrive when a judiciously selected operation will be truly conservative.

Arthrectomy, or *erasion*, consists in opening the joint and scraping out all of the diseased tissue. It may be accomplished through one opening beside the patella, but there is no objection to making one on either side of that bone. Every nook and corner of the joint must be reached with scissors and scoop. It is well to extend the opening well up into the upper pocket of the joint, thus insuring ready access to it. The joint should be frequently irrigated throughout the operation with a bichlorid solution. If the operator is satisfied that he has removed all of the diseased tissue, the joint surfaces should be thoroughly rubbed with iodoform and the wound closed. A surgical dressing and plaster cast should be applied, and, if all is well, it need not be changed for a month. Should high temperature follow, the wound must be reopened and drainage established. Rubber drainage-tubes should not be used, because their track always becomes tubercular.

When the operator is not satisfied that he has been able to get all the diseased tissue out, he should pack the joint with iodoform gauze and leave it open.

When the disease has not been too extensive, it may be possible to save a movable joint by this operation, but it should never be promised. Aside from the hope of saving a movable joint, this operation should always be chosen for a child, because it will not interfere with the growth of the limb as excision would. After this operation, either a plaster cast with crutches, or a long hip- or knee-splint must be worn for many months, to protect the weakened joint and to prevent a relapse.

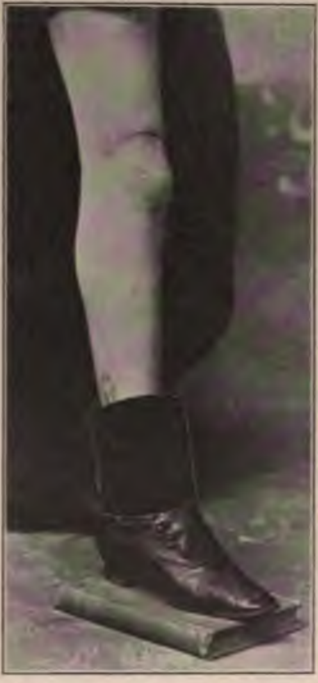

Fig. 152.—Knee five years after excision.

Excision of the knee is the operation of choice in adults, and, in properly selected cases, the results are very satisfactory (Fig. 152). It should never be resorted to until mechanical resources have failed. On the other hand, it must not be postponed too long or it may become necessary to amputate later. In adults this disease does not show the same tendency to recovery that it does in children, and what may be a hopeful case in a child might demand excision in an adult.

In adults, when abscesses form or when the disease becomes extremely chronic, excision is indicated.

For the past two years the writer has discontinued the use of the Esmarch bandage and the wire nails in this operation. The hemorrhage is less without the bandage than with it, because of the oozing afterward when it is used. Serious loss of blood has sometimes followed the use of the bandage, and frequently the dressings require changing on account of the oozing. Without the bandage, the blood-vessels are caught and tied, and no trouble follows. The nails left sinuses that frequently became tubercular, and experience teaches that they are unnecessary. The bones can be held in place by chromic gut and the dressings, or, what is better, they can be dovetailed, as suggested by Fenwick and so frequently practised by Phelps. The writer has usually chosen a U-shaped incision, with the convexity upward, because it insures access to the upper pocket of the joint (see Fig. 152). It should begin well back over one condyle and extend across to a corresponding point over the other one, extending into the joint.

The patella should always be removed. The joint is opened by flexing the knee, and the bones are sawn off.

When the bones are not too badly diseased, the tibia should be sawn so as to leave a groove across the end, and the femur so as to leave a ridge running cross-wise that will fit into the groove in the tibia. This manner of sawing the bones insures their close approximation and prevents displacement. When the bones are extensively diseased they should be cut square across, beyond the diseased point, and the flat surfaces approximated and held by chromic gut sutures. The end of the tibia should be sawn off parallel with the original joint surface. The condyles must be severed parallel with the joint surface, exercising great care to make the piece removed of the same thickness throughout. When deformity exists, the bones of course are shaped so as to overcome it.

After the bones are sawn their ends should be carefully examined and any foci of disease scooped out. The cavities left after this scooping process may be filled with iodoform or left to be filled with blood-clot. When the compact tissue of the bone is healthy, quite large excavations can be safely made in the cancellous tissue.

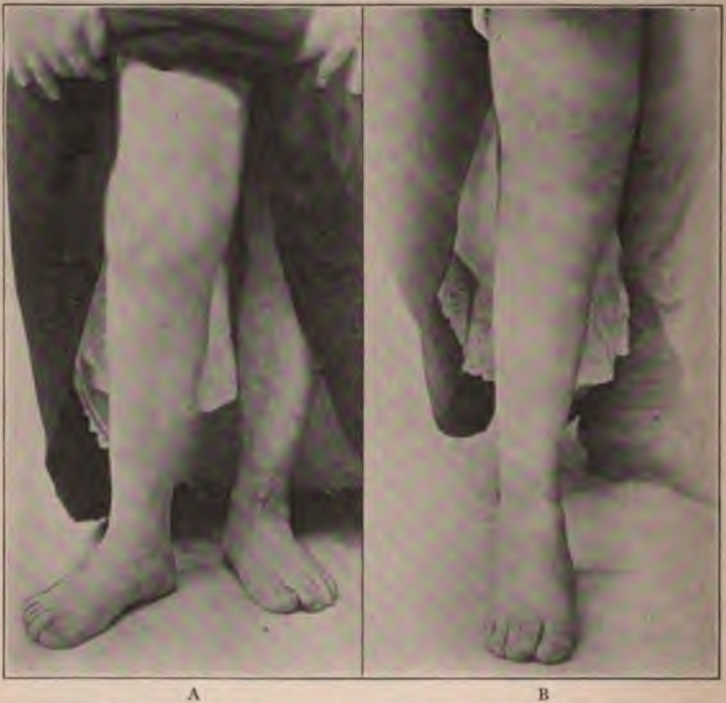
A B

Fig. 153.—A, knee just before excision; B, three months after excision.

After completing the bone operation, all diseased soft tissues must be removed with knife and scissors. Search should be made for sinuses extending up and down from the knee, and when found they should be thoroughly curetted and iodoformized. Bichlorid solution should be freely used.

After the bones are carefully adjusted, the wound should be closed by a running suture of catgut, without drainage. A dry surgical dressing should be applied, and over it a plaster-of-Paris cast extending from the toes to the body. When for any reason the thigh cannot be grasped firmly enough, the cast should extend up to the ribs. This dressing should not be changed for a month, except for indications. A temperature over 102° F. demands a change of dressing. At the end of a month the wound will usually be found perfectly healed. A close-fitting plaster cast should then be applied, and the patient encouraged to get up on crutches.

The limb should be protected by a cast until it is perfectly solid, and early walking upon it should not be encouraged.

Internal Derangement of the Knee.—This name was suggested by Hey, in 1803, when he gave the history of a number of cases coming under his observation in which some change took place suddenly, within a knee-joint, which locked it so that it could not be extended.

This locking is undoubtedly caused in the majority of cases by a displacement of one of the semilunar cartilages. It usually occurs in persons between twenty and fifty years of age, but may occur in childhood. Howard Marsh, in his work on "Diseases of the Joints," gives the history of a number of cases of traumatic origin. Cases coming under the writer's observation have been caused by a sudden twisting while running, by bicycle riding, holding a stick of wood on a "saw-buck," and by kicking at an object and missing it.

Symptoms.—The person will have flexed the joint forcibly, and will suddenly be unable to extend it, and may be unable to walk. At times this locking is accompanied by excruciating pain, and at other times there may be little or no pain. At first attacks, the locking is apt to be followed by a mild synovitis, which may continue for two or three weeks. A person who has suffered from one attack is very likely to have others, but later attacks are less liable to be followed by inflammation. Sometimes, when the patient cannot move the joint himself, the surgeon can move it freely. The locking is caused either by the cartilage (usually the inner one) being torn loose from the tibia, so that its margin slips back between the femur and tibia, thus preventing the joint from being extended, or the ligaments are so lax as to allow the tibia to slip back far enough to catch the edge of the cartilage under the condyle of the femur. Occasionally the cartilage can be felt projecting in an abnormal position, or a depression can be felt at the anterior margin of the tibia. In the majority of cases, however, nothing abnormal can be seen or felt about the joint.

Diagnosis.—It is often impossible to make a differential diagnosis between this and a loose body in the joint, unless the loose body can be felt by the surgeon. The dislocation of the cartilage is usually caused originally by an accident, which establishes the diagnosis.

Treatment.—The locking can usually be overcome by flexing the knee to the limit, pulling the tibia away from the femur, and rotating it. If the first effort fails, the manipulations should be repeated. In painful cases an anesthetic should be administered. The manipulations should be gentle, so as to avoid injury to the joint. After reduction, the joint should be put at rest for a time, to prevent inflammation.

Cases have been reported in which the misplaced cartilage has become diseased, requiring its removal. Patients who have this trouble usually become accustomed to unlocking it themselves. The wearing of an elastic knee-cap will sometimes seemingly prevent its recurrence.

Bursitis, or "housemaid's knee," is of interest to the orthopedist only in point of diagnosis. It is a swelling over the lower end of the patella, caused by the inflammation of a bursa (Fig. 154). The inflammation may be simple or purulent, and is accompanied by the ordinary symptoms of inflammation. When the inflammation becomes chronic or is suppurative, the best treatment is to lay the sac open and pack it with gauze until it heals from the bottom.

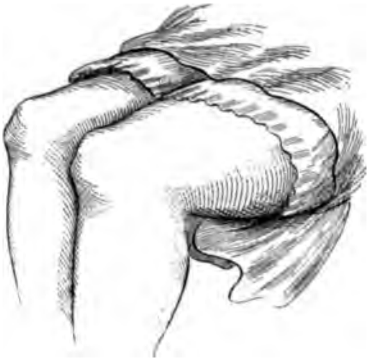

Fig. 154.—Housemaid's knee.

The **acute diseases of the knee** are in no way peculiar, and need no further description than that given in chapter xv.

CHAPTER XX.

DISEASES OF THE ANKLE AND TARSUS.

The ankle is subject to all of the acute inflammations to which other joints are subject, and is to be treated upon the general principles laid down in chapter xv.

SPRAINED ANKLE.

The ankle, owing to its location, is peculiarly liable to sprain,—a condition which will often tax the surgeon's skill to the utmost, in both its early and late stages. The principles of treatment laid down for sprains in chapter xv are applicable here.

Dr. V. P. Gibney has detailed a valuable method of treatment for sprained ankle,* of which the writer, after some experience with it, can speak in the highest praise. Strips of adhesive plaster about 12 inches long and 1 1/4 inches wide are used. For a sprain of the ankle in which the bottom of the foot has been turned in and the ligaments about the outer malleolus torn, the first strip is applied to the foot beginning just back of the little toe and extending along the lower border around the heel to about the middle of the inner side of the foot (Fig. 155, A). The second strip begins on the outer side of the leg, about six inches from the sole, and passes down parallel with the

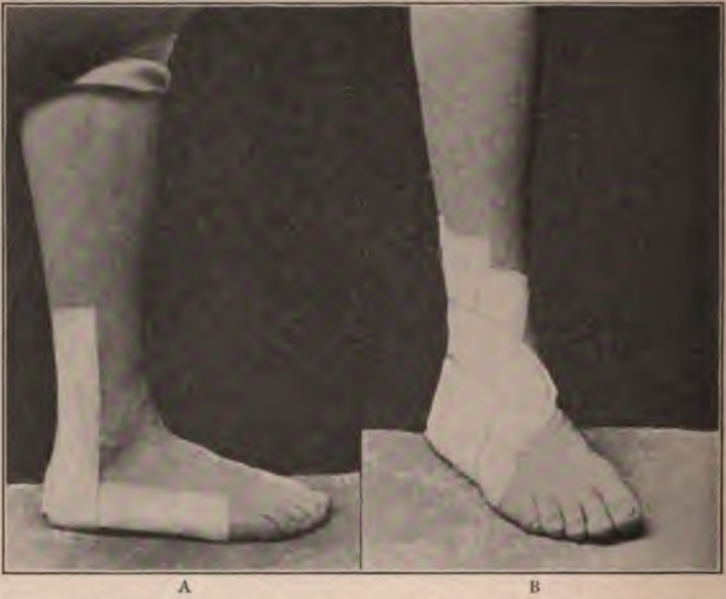

Fig. 155.—A, showing manner of applying first two strips of plaster for sprained ankle; B, dressing for sprained ankle complete.

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* *N. Y. Med. Jour.*, Feb. 16, 1895.

tendo Achillis, across underneath the heel, and up on the inner side to a point just above and posterior to the inner malleolus. Other strips are applied in the same manner, each one overlapping the last one about half-way, until the whole outer side of the foot is covered (Fig. 155, B). These strips should be reinforced about the outer malleolus by other strips running crosswise. Care should be exercised not to completely encircle the foot or leg at any point, for fear of obstructing the circulation.

When this dressing is applied to a recently sprained ankle and covered by a roller-bandage, the patient can put on his boot and use the foot. When other parts of the foot are the seat of injury, the strips must be applied to suit the case, but the principle is the same—viz., the supporting of the torn ligaments.

Cases of chronic sprained ankle frequently come to the orthopedist for treatment, after all varieties of poultices and liniments have been tried without relief. The foot will be cold and blue, and the toes will resemble the fingers of a patient who has worn splints for a broken arm for some time. It will be abducted, slightly extended, and painful when manipulated or used. There may or may not be swelling. The peroneal group of muscles is usually tense. The patient is often obliged to use crutches, and when he does walk, does so with a limp similar to that of flat-foot. By perseverance, very satisfactory results can be secured in these cases.

The patient should be given an anesthetic, and the foot freely moved in every direction until abnormal resistance is overcome, and all the cracking caused by the breaking of adhesions has ceased. Whitman advises that the foot be forced into an equinovarus position, and held there by a plaster cast for a time.* A plaster cast should be worn until all pain and tenderness from the manipulation have disappeared, when passive motion and massage should be employed. The foot should be moved in every direction, particularly in adduction. The galvanic current is helpful. As soon as possible after the operation the patient should begin to walk, even when it causes him some pain, for many of these cases would not have become chronic had the patient used the foot in time. The shank of the shoe should be built up, and the inner side slightly elevated, as for flat-foot (see Fig. 69).

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* "Trans. American Orthopedic Association," vol. iii, p. 73.

In neurotic patients it is possible to have a condition resembling a chronic sprain, which is purely neurotic. In such a case the general condition of the patient needs more attention than the foot.

DISLOCATED TENDONS.

In injuries about the ankle, the tendons about the outer malleolus sometimes become dislocated forward, causing tenderness and weakness. When they cannot be kept in place by bandages or elastic anklets, it is advisable to fasten them in place with catgut sutures through an open wound, and apply a plaster cast until they are fixed in their new location.

TUBERCULAR DISEASE.

It is not practical to differentiate between a tubercular osteitis and a tubercular synovitis, because they have many symptoms in common, and eventually all structures are involved, no matter in which tissue they begin. It is undoubtedly true, here, as elsewhere, that the majority of cases begin as an osteitis, especially in children. It is also, probably, true that some cases which begin as a simple synovitis eventually become tubercular.

Tubercular arthritis of the ankle begins, according to the latest observations, most frequently in the astragalus, next in the tibia, next in the os calcis, and least frequently in the synovial membrane. It is quite generally believed, however, that in adults there is a larger percentage of disease of the ankle beginning as a synovitis than in the larger joints. This disease is comparatively rare, coming next in frequency to the knee.

Causes.—The causes are the same here as in other joints, but it is remarkable that the disease is so rare, because the ankle is frequently exposed to traumatism. This is a disease of childhood in the majority of cases.

Symptoms.—As a rule, this is not an extremely painful disease, although exceptional cases occur in which pain and night-cries are prominent symptoms. The child will first be noticed to limp and to favor the joint, and, upon examination, restriction of motion and muscular spasm will be found. At an early date, when the disease is confined to one of the bones, the swelling, local heat, and tenderness will be directly over that bone. Later, when the joint is involved, the swelling will be found directly over the joint, both in front and behind. The natural depressions about the malleoli will disappear, and the calf muscles will atrophy (Fig. 156). Quite a difference in measurement can be found in the calves at an early date. The tendo Achillis will become contracted and the foot drawn into an equinus position.

Diagnosis.—The diagnosis is to be based upon muscular spasm, swelling of the ankle, atrophy of the calf, local heat and tenderness, and a limp. The limp is peculiar and is due to the stiffening of the joint and the tenderness. It will be noticed that, instead of throwing the weight of the body forward upon the ball of the foot and flexing the ankle as he steps forward, the patient will evert the toes and throw his weight upon the inner side of the foot, and thus avoid the necessity of flexing the joint. At an early period, the diagnosis of an osteitis in one of the tarsal bones may be based upon the presence of local heat, swelling, and tenderness.

It will be necessary to differentiate between tubercular arthritis of the ankle and tenosynovitis. In tenosynovitis the swelling extends around under the malleolus, and ligamentous crepitus can be felt, and sometimes heard.

Chronic sprain of the foot and ankle may resemble tuberculosis, and may eventually become tubercular. It is quite important to differentiate between these two affections, because their treatment is just the reverse, and it is not always easy to make the differentiation. The sprain will give the history of a traumatism, and will not be accompanied by the characteristic swelling, heat, and atrophy of tuberculosis, although after a time there will be some atrophy from disuse. The sprained foot becomes cold and blue, but in tuberculosis it is hot and of a natural color, or whiter, with enlarged veins showing.

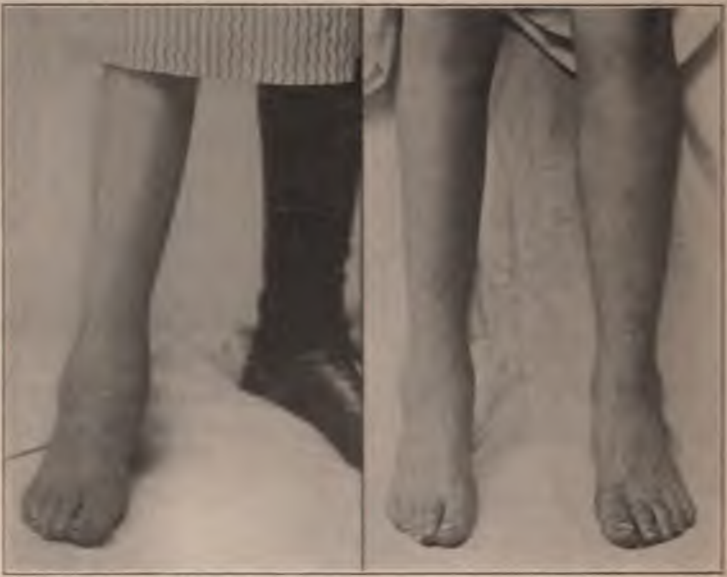
A B

Fig. 156.—A, tuberculosis of ankle; B, after recovery.

Prognosis.—The prognosis in tubercular arthritis of the ankle and tarsus in children is quite favorable, but in adults it is bad, because it is extremely chronic, shows a persistent tendency to grow worse, and is very liable to end in pulmonary tuberculosis.

Treatment.—The consensus of opinion of modern orthopedists is that rest and protection afford the best results in this disease, both as to function and mortality.* Operative treatment, when resorted to early, may result in a more speedy cure, when successful, than could possibly be expected from non-operative methods, but, unfortunately, unless extremely radical it fails to cure, and the radical operation is followed by progressive shortening and disability that will not compare favorably with cases cured by mechanical methods.

The writer has tried both methods faithfully, and has been greatly disappointed in operative measures about the tarsus in children. Frequent relapses was the rule following gouging and curetting, ending finally in death, in a large percentage of cases, from meningitis or other secondary tuberculosis. It was only when entire bones or the whole ankle-joint were removed that good results followed, and in those cases where the ankle was removed the ultimate result did not compare favorably with results following rest and protection. It was only in those cases in which the disease was confined to one bone, and that bone was completely removed, that the results were perfectly satisfactory.

In adults, when the case is not far advanced, rest and protection should be given a faithful trial, but the outlook is not promising. The writer is thoroughly convinced that when tuberculosis is well advanced in this locality in an adult, the only safe treatment is by amputation, because it has very little tendency toward recovery under rest-treatment, and operative treatment, other than amputation, is disappointing and dangerous. The very fact that 35 different methods have been suggested for performing excision of the ankle shows that it is a disappointing operation. The time required for treatment in adults is long, and the danger from fatal complications is imminent.

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* See discussion of Dr. Scudder's paper, "Trans. American Orthopedic Association," vol. ii.

The best method of treatment, in the writer's experience, is by means of a plaster cast and crutches. In a child, the healthy foot should be elevated so that he cannot reach the floor with the lame foot. The Thomas knee-splint affords a very good means of protection (see Fig. 150).

Extension is not so conveniently applied in this joint as in the knee or hip, because of the difficulty of getting hold of the foot. Fortunately, extension is rarely necessary, the pain and spasm being controlled by fixation alone. When spasm, pain, and night-cries fail to yield to fixation, extension is indicated and may be secured by Dr. Sayre's ankle-extension apparatus (Figs. 157 and 158). This apparatus consists of a steel sole-plate, a collar around the leg just below the knee, and an anterior and posterior upright. The sole-plate is fastened to the foot by strips of adhesive plaster and the collar is fastened to the leg by the same means. Extension is made by means of a ratchet and key arrangement in the uprights.

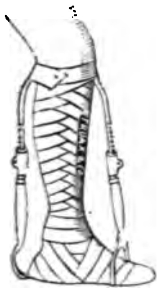
Fig. 157.—Sayre's ankle-joint splint.

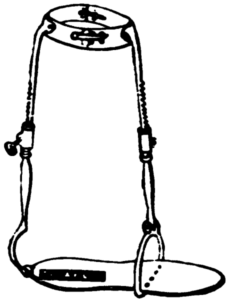
Fig. 158.—Sayre's ankle-joint splint.

When a plaster cast is applied, the foot should be placed at as near a right angle to the leg as is possible without using force. When deformity exists, an effort should be made at each change of plaster to overcome it. When not too far advanced, the deformity can be overcome in this simple manner, but when the tendo Achillis is firmly contracted, it may be necessary to cut it in order to overcome the deformity. When the limb is not too hairy, the cast is best applied directly to the skin, and should be changed every two or four weeks, according to circumstances. A little vaselin applied to the skin just before applying the plaster will add to the patient's comfort. When a child who is convalescing will persistently bear weight upon the foot, the surest and best way to protect it is by means of the Thomas knee-splint shown in figure 150.

The joint can be pronounced cured when neither spasm, heat, nor soreness is present, and when the amount of motion in the joint increases with gentle use.

In every case coming under the surgeon's care with abscesses or sinuses, it is of vital importance to ascertain whether the abscess communicates with the joint or not. When it does not communicate with the joint, by prompt removal of the whole of the diseased part the joint may be saved. Mere scraping out of the sinus or abscess cavity will lead to disappointment.

Of the various methods recommended for excision, those gaining entrance to the joint from the outer side are the most practical. The one suggested by Kocher is, in the writer's opinion, far superior to any other, and is made in the following manner (Fig. 159): An incision is made extending from the outer side of the extensor tendons across the outer side of the joint to the tendo Achillis. The peronei muscles are cut across, and the joint opened from the outer side. All of the ligaments of the joint are severed without disturbing the extensor tendons or the heel cord, and the foot is completely dislocated inward.

When it is certain that the outer malleolus will be sacrificed, it greatly facilitates matters to cut it off with a chisel in order to open the joint. It is usually advisable to remove the whole of the astragalus, and as much must be sawn from the tibia and fibula as is necessary in order to remove all diseased tissue.

After every particle of diseased tissue has been removed, the foot is replaced, the peroneal muscles sutured, the wound closed, and a surgical dressing applied. Over this a plaster bandage should be applied, taking care to hold the foot at a right angle to the leg while the plaster is setting.

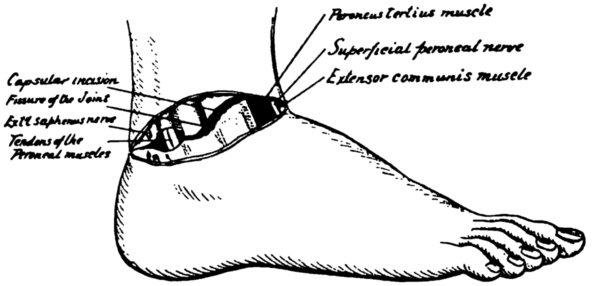

Fig. 159.—Kocher's excision of the ankle.

The writer believes that the suggestion of Professor Studsgaard, of Copenhagen, for operations upon the anterior row of tarsal bones and the proximal ends of the metatarsal bones is a good one, although he has had no experience with it. He advises that the foot be split from before backward, between the first and second toes, until the diseased part is exposed.

CHAPTER XXI.

DISEASES OF THE WRIST AND PHALANGES; TENOSYNOVITIS.

TUBERCULAR ARTHRITIS.

THE only disease of the wrist worthy of special note is tubercular arthritis. It is a comparatively rare disease and is most frequent in adults. Cheyne states that of 919 cases of tubercular arthritis, only six were of the wrist and hand. He further says that he believes the disease begins more frequently as a synovitis than as an osteitis, but admits that it is difficult to prove. The radius is the bone most commonly affected, and the proximal ends of the metacarpal bones next.

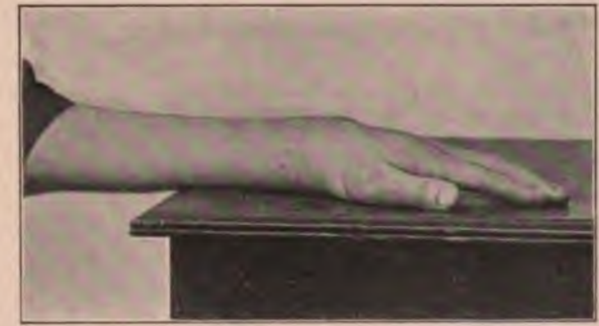

Fig. 160.—Tuberculosis of the wrist.

The causes are the same as for other joint-tuberculoses.

Symptoms.—There is swelling, most marked on the dorsum (Fig. 160), accompanied by local heat, and atrophy of the arm. Pain is not nearly so severe as in some other joints, but the part is very sensitive to touch or motion. Flexion usually occurs with restriction of motion. The tendon sheaths are very likely to become secondarily involved, which adds very materially to the gravity of the disease.

The thumb lies parallel with the fingers in quite a characteristic manner.

Diagnosis.—The diagnosis is based upon the above symptoms and presents no difficulty in a well-marked case, since nothing else resembles it except tenosynovitis. When the sheaths alone are diseased, the disease extends up and down along the tendons and can be felt under the skin. There is frequently ligamentous crepitus.

Prognosis.—The prognosis in this disease is always grave because of the marked tendency to the development of pulmonary tuberculosis. In adults it is almost certain to end in this way, and the two diseases are very apt to be found when the wrist disease has existed for some time.

In children the immediate results are better, but they rarely, if ever, live to advanced age. The fact that the tendon sheaths are frequently involved adds to the gravity of the prognosis. The functional results in children are good, but in adults they are bad. This is partly due to the necessary difference in treatment.

Treatment.—In children the rest-treatment yields good results, and can be best carried out by means of plaster-of-Paris. The cast should begin below the elbow and extend to the knuckles only. This dressing allows free motion of the fingers, and has a tendency thus to prevent adhesions of the tendons to their sheaths. The hand should be carried in a sling, and held half-way between pronation and supination. The casts should be changed about once a month, and worn continuously until six months after all active symptoms have disappeared.

In adults the outlook from rest-treatment is not very favorable. Owing to the insidious manner in which the disease usually begins, it is apt to be well advanced when first brought to the surgeon. In an adult suppuration and sinuses should be looked upon as an indication for operative interference quite early, because of the known tendency toward the development of phthisis. The choice of operations lies between extensive excision and amputation, because, owing to the anatomic construction of the part, arthrectomy is not applicable.

When the disease is quite extensive or progressing rapidly, or when the tendon sheaths are involved, amputation is the most conservative treatment. When there is well-marked disease of the wrist, with beginning phthisis, amputation should be promptly resorted to. When there is well-marked phthisis, accompanied by wrist disease which is causing the patient much suffering, amputation is good treatment, not only because it will relieve him of his suffering, but because it often has a salutary effect upon the lung trouble. Patients afflicted in this way will often make very marked improvement after an amputation.

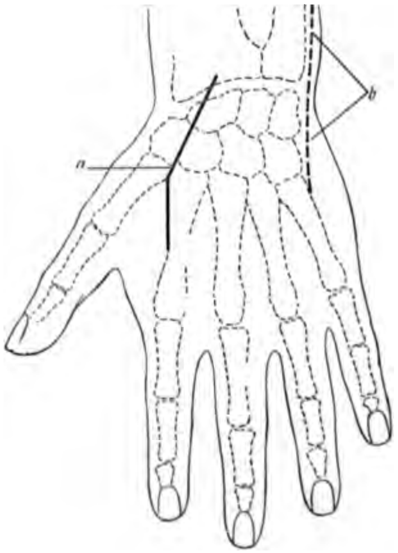

Fig. 161.—Lister's double posterior incision for excision of the wrist.

When the patient's health is good and the disease is not too extensive and does not involve the tendon sheaths, excision may be considered. Only a radical operation should be performed, because partial operations are disappointing and dangerous. Gouging and scraping the carpus are not to be recommended.

The double posterior incision of Lister (Fig. 161) affords freer access to the joint than any other with which the writer is familiar, but the operation is, at best, rather a difficult one, on account of the many important anatomic structures surrounding this joint.

The operation suggested by Studsgaard, of Copenhagen, and first reported in America by Mynter, of Buffalo, N. Y.,* appears to the writer to be better than any other yet suggested. Mynter made an incision between the second and third metacarpal bones, splitting the hand back to the carpus, when he found it very easy to remove all diseased structures. The result reported, eight weeks after operation, was very satisfactory.

TENOSYNOVITIS.

About the wrist and the ankle the tendon sheaths are subject to both acute and chronic inflammations. The long head of the biceps humeri is a frequent seat of acute and subacute inflammations, but the writer has never seen a tubercular inflammation of this part independent of the shoulder-joint. About the wrist and ankle, however, a tubercular inflammation is not uncommon. The acute inflammations occur in sprains and in acute articular rheumatism, and require no special treatment beyond what is required for these affections.

Tubercular tenosynovitis may be either primary or secondary to joint-tuberculosis, and occurs most frequently in the flexor tendons of the hand and in the peroneal group.

The ganglion, or hygroma, so frequently seen on the dorsal surface of the wrist, may or may not be connected with the tendon sheaths. It is usually an extension from the wrist-joint.

Tubercular tenosynovitis assumes two forms: first, the hygroma, containing gelatinous fluid and rice bodies, and, second, the fungous variety. Formerly, the first variety was considered a simple chronic inflammation, but recently tubercle bacilli have been demonstrated in the rice bodies and synovial membrane. In the fungous variety, the sheath, and frequently the tendon, are covered with tubercular granulation tissue. When secondary, it is usually of the fungous variety. This affection is of importance to the orthopedist, because it so often complicates ankle- and wrist-joint disease, and because when it is an independent disease it must be diagnosticated from joint-disease. It is always a chronic disease, and shows no tendency to recover without proper treatment. As an independent affection, the prognosis is good under operative treatment. As a complication of joint-disease, it adds very materially to its gravity.

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* See "Trans. American Orthopedic Association," vol. vii.

It is not a painful disease, but eventually becomes more or less disabling. It is not highly sensitive to pressure and does not yield the sense of heat to the surgeon's hand that a joint-tuberculosis does. There is a sense of fluctuation, and the swelling extends along the course of the tendons. Sometimes a sense of crepitation can be felt as the tendons are moved. About the ankle it is almost invariably the peroneal tendons that are involved, and the swelling can be seen and felt to extend around the outer malleolus. At the wrist, in the hygromatous form, there may be an enlargement on the palmar surface of the wrist and in the palm of the hand, the annular ligament making a depression between the two. When the rice bodies are present, they may be forced backward and forward from one side of the annular ligament to the other.

It is very important to differentiate between this affection and a joint-disease, because healthy joints have been opened when only a tenosynovitis existed.

Treatment.—In the hygromatous form the sheath should be laid open and the rice bodies and the surplus of the distended sheath removed. The part should then be thoroughly irrigated with bichlorid or iodin solution, and the sheath closed with catgut. When necessary, the annular ligament may be cut and afterward united.

After closing the outer wound and applying a surgical dressing, a plaster cast should be applied to keep the part at rest. The result is usually a prompt and permanent cure. In the fungous variety, an Esmarch bandage must be applied, and the tendon lifted out through an incision extending the whole length of the disease. It must be cleared of every trace of granulation tissue, and the sheath and all of the disease removed. It will often be found that the disease has eaten through the sheath and extended into surrounding tissues.

After all of the diseased tissue has been removed, the tendon should be replaced and held in place by buried catgut sutures, and the outer wound closed. A dressing should now be applied and the Esmarch removed, allowing a clot to form, from which nature forms a new sheath.

A permanent fixation-bandage must not be applied in this class of cases, for after the third or fourth day it is very important that the fingers be gently moved, in order to keep the tendons from adhering to the surrounding parts. The prognosis in these cases is very good, providing the technic has been perfect.

DISEASES OF THE PHALANGES.

The joints of the fingers and toes are occasionally the seat of disease, and differ from other joint-diseases only on account of their size. They are very commonly affected by acute rheumatism and by rheumatoid arthritis.

The first joint of the great toe is the favorite seat of gout.

Tuberculosis occurs occasionally in these joints. While the disease may be cured by fixation, it is an open question whether amputation is not the best treatment, because one finger or toe is not worth the time and trouble it would cost to cure the affection. When the disease attacks the thumb, excision should be performed.

The disease known as spina ventosa, occurring in children, is a tubercular osteomyelitis, and usually disappears under rest-treatment. When sinuses exist, they should be enlarged and the medulla scooped out.

CHAPTER XXII.

DISEASES OF THE ELBOW-JOINT AND SHOULDER-JOINT.

DISEASES OF THE ELBOW-JOINT.

Tubercular arthritis is the only disease of special interest about this joint. It is not nearly so common as hip or knee disease, but occurs more frequently than wrist or shoulder disease. It develops in the majority of instances in young adults, but may occur at any age. The majority of cases begin as an osteitis, most frequently in the olecranon, next in the humerus, and very rarely in the radius.

Symptoms.—This disease is apt to come on insidiously, the first symptom being slight limitation of motion. The pain is not usually so severe as in hip or knee disease, but the joint is sensitive to motion. Flexion and pronation gradually appear. The swelling can first be seen on the dorsal surface on either side of the olecranon, and, as it increases, the arm assumes a spindle shape, being largest at the elbow. Beyond the swelling, both above and below, the arm is atrophied (Fig. 162). The writer has seen one case in which the veins were so enlarged as to lead to suspicion of sarcoma.

Diagnosis.—The history of the case, the peculiar shape, and the restriction of motion will be sufficient evidence upon which to base a diagnosis. Syphilis affecting this joint has been known to resemble tuberculosis very closely, but other symptoms and a history of syphilis would establish the diagnosis.

Prognosis.—The prognosis as to usefulness of the joint is not good, because, owing to its construction, the joint is very likely to become ankylosed. The fact that so many of these cases occur in adults makes the prospect of a cure from rest-treatment hardly so good as it would be in diseases of the other joints; and while the tendency toward phthisis is not so great as in wrist-joint disease, a goodly number end in that way.

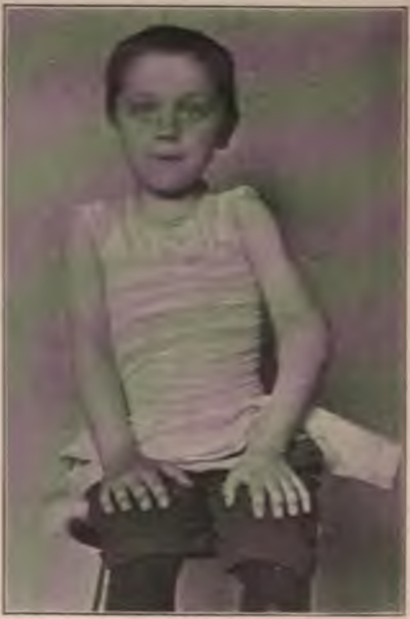

Fig. 162.—Tuberculosis of the elbow (Gillette).

Treatment.—When the disease occurs in childhood and is brought to the surgeon before suppuration and sinuses are present, the treatment is rest by means of a plaster cast. The joint should be flexed to a right angle, and the hand held half-way between pronation and supination, because this is the most useful position when ankylosis occurs. The bandage must extend from the wrist to the shoulder, and when the radius is involved should begin at the knuckles, leaving the thumb and fingers free. The hand may be placed in a sling.

In a child, when the disease has become extensive or is progressing in spite of rest, the joint should be opened and all diseased tissue removed by erasion or atypic excision, according to its location. The best way to open the joint is by a longitudinal incision over its center and a temporary separation of the olecranon.

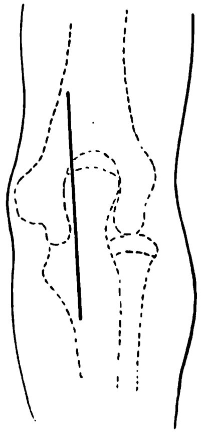

Fig. 163.—Langenbeck's incision for excision of the elbow.

In adults, when the patient is seen early, treatment by plaster-of-Paris or other fixation apparatus should be tried, and in some cases will be followed by a cure, but probably with ankylosis. If suppuration has already taken place, or if, after a few months' trial of rest, the disease is evidently progressing, operation should be resorted to. Operative measures are to be recommended at a much earlier period in this than in the hip- or knee-joints, because results from operation are more satisfactory, and from rest less so, than in these joints. It is also believed by those advocating early operation that pulmonary complications are less likely to occur than when the slower methods are followed. Senn recommends partial rather than complete excision, as being equally safe and as affording better results (see "Diseases of Bones and Joints").

Langenbeck's long posterior incision (Fig. 163), aided, if need be, by short transverse incisions, affords easy access to the joint. A temporary separation of the olecranon process should be made, because it affords perfect access to the joint, and it can be readily fastened on again by nails or wire.

Where a partial excision is contemplated, an Esmarch bandage should be applied to enable the operator to see the diseased tissue ; but when a complete excision is to be performed, the writer prefers not to use the bandage. In performing a partial excision, it is not sufficient to simply scrape out bone cavities, for this is very liable to be followed by relapse, but a stratum of healthy tissue should be removed as well.

The ulnar nerve should be isolated early and protected from injury. When the disease affects all of the bones, a formal excision should be made by sawing off enough of each one to leave only healthy tissue. If the olecranon is found diseased, it must be removed ; but when it is healthy, it must be nailed or wired in place. In case it is removed, the tendon of the triceps should be fastened to the remains of the ulna by catgut or silk.

The elbow should be flexed to a right angle, the hand half pronated, and a snug-fitting plaster cast applied over the surgical dressings. If sinuses have existed, it will be wise to drain, but otherwise it is not necessary. The dressings should be allowed to remain for a month, providing no abnormal temperature develops, when the wound will be healed and passive motion can be commenced.

Too early passive motion is not advisable, since it is more likely to cause ankylosis than to prevent it.

DISEASES OF THE SHOULDER-JOINT.

This joint is not a frequent location of any disease, but it is sometimes affected by the various acute inflammations considered in chapter xv. Next to the knee-joint, it is the most frequent location of rheumatoid arthritis.

Tubercular inflammation of the shoulder is a rare disease. Cheyne found that, by putting together a large number of cases of joint-disease reported by various writers, the shoulder-joint furnished only 1.5 per cent. of the whole.

Most authors say that it is essentially a disease of young adult life, but Townsend's report of his experience at the Hospital for the Ruptured and Crippled shows an average age of ten years.* The writer's cases have all been in adults.

The disease begins, as a rule, in the head of the humerus, the focus being near the periphery, just underneath the articular cartilage. It occasionally begins in the scapula and in the synovial membrane. The cause of tuberculosis is the same here as in other joints.

Caries sicca, described by Volkmann, sometimes occurs in the shoulder-joint. It is a form of tuberculosis occurring in young adults, characterized by a slow destruction of the head of the humerus without suppuration. It disappears after about two years, with ankylosis.

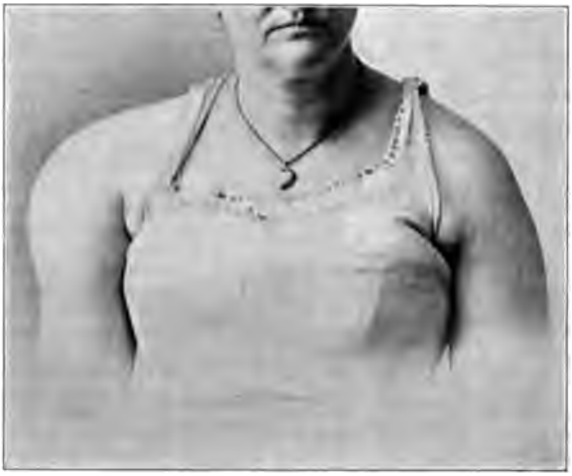

Fig. 164.—Tuberculosis of the shoulder.

Symptoms.—Tuberculosis of the shoulder (Fig. 164) usually comes on slowly, pain being the first symptom noticed. Pain is apt to be a prominent symptom, and at times is very severe. Atrophy begins early, and is specially noticeable in the deltoid. The scapular muscles also become markedly atrophied. Muscular spasm is a characteristic symptom, and can be elicited by abducting the arm. Motion is restricted, and may be entirely absent. The loss of motion may be overlooked, because it is so largely compensated for by the movements of the scapula. Swelling is present, but is masked by the atrophy of the deltoid. The axillary lymphatic glands are enlarged, on account of their close proximity.

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* "Trans. American Orthopedic Association," vol. vii.

Shoulder-joint disease frequently accompanies phthisis and other diseased joints, the shoulder-joint disease being secondary.

Diagnosis.—The diagnosis is to be based upon the pain, atrophy, limitation of motion, and muscular spasm. It is not always easy, at first, to distinguish this disease from rheumatoid arthritis. The latter occurs in older patients, is not accompanied by the spasm and extreme atrophy belonging to tuberculosis, and is often accompanied by like disease in other joints. In rheumatoid arthritis, the head of the humerus is more prominent in front, and the characteristic creaking is present.

Prognosis.—The prognosis in children, under proper treatment, is good. In adults, a large percentage develop phthisis, and when recovery does take place it is almost invariably with ankylosis. The disease continues from two to four years.

Treatment.—In children, most writers agree that mechanical treatment yields satisfactory results and is to be recommended. Rest is secured by fastening the arm to the body by bandages or adhesive plaster. In quite young adults, when the disease is not too far advanced, the rest-treatment should always be tried. In severe cases, or in well-established cases in older adults, the writer is satisfied that operative treatment will save more lives and more useful arms. Excision is to be recommended in the shoulder much earlier than in the hip, because the functional results are good, and because there is more danger of lung complications. Most statistics of shoulder-joint excisions are based upon old-time surgery, and do not apply at the present time. With modern methods, the operation is not a dangerous one. A complete excision of the joint is rarely needed, since the disease is mostly confined to the head of the humerus and the synovial membrane.

The best incision is a straight one, over the anterior inner aspect of the joint (Fig. 165). All diseased tissue must be removed. As a rule, it will be found necessary to remove the head of the humerus and the synovial membrane.

When no sinuses are present, the wound may be closed without drainage, but with sinuses this is not practical, because of the mixed infection. The arm should be held in place by a plaster-of-Paris bandage. The prospect for a useful joint after this operation is good.

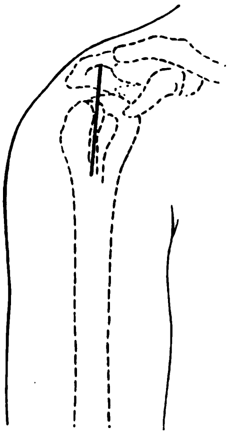

Fig. 165.—Incision for excision of the shoulder.

In caries sicca, operative treatment is not necessary, since the tendency is toward recovery in a comparatively short time, with rest-treatment.

CHAPTER XXIII.

ANKYLOSIS; OLD DEFORMITIES.

The original significance of the term "ankylosis" was an angular deformity, but at the present time it means a stiffened joint without regard to position. True ankylosis consists of a bony union between the joint surfaces. False ankylosis consists of a stiffening of a joint by intra-articular fibrous bands and peri-arthritic contractions.

Causes.—The majority of cases of ankylosis are the result of some form of inflammation. This is followed by the formation of granulation tissue, which later becomes connective tissue. In chronic inflammations the granulation tissue may destroy the cartilage so that it is entirely replaced by connective tissue. In some instances the cartilaginous surfaces become united by cartilage. In true ankylosis there is a deposit of bone in the new tissue, so that there is true bony union. In some specimens a combination of fibrous, cartilaginous, and bony union is found.

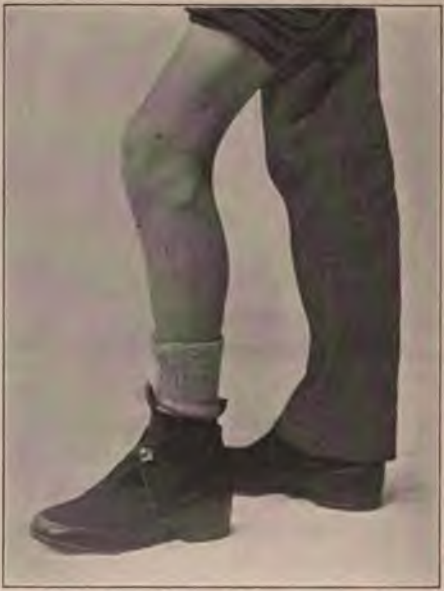

Fig. 166.—Ankylosis resulting from acute suppurative synovitis. A very satisfactory result was obtained by breaking up under anesthesia.

Suppurative inflammation due to traumatism is very liable to be followed by ankylosis (Fig. 166). Fractures into or near joints may be followed by ankylosis, when it is most frequently of the false variety, as a result of the inflammation following the traumatism. It may, however, be mechanical, from a change in the shape of the articular surfaces. False ankylosis may also be due to cicatricial contraction or adhesions in the soft parts about the joint. Direct adhesion of opposing surfaces of synovial membrane may take place, causing false ankylosis.

Tubercular inflammations very commonly result in more or less loss of motion and occasionally in complete bony ankylosis. It should be remembered that keeping a joint at rest does not cause ankylosis, and when ankylosis occurs after rest-treatment, it is due to the disease and not to the treatment.

Diagnosis.—The only problem the surgeon is called upon to solve is whether the ankylosis is true or false, and, ordinarily, this is not difficult. It is important to remember, however, that what appears to be a bony ankylosis may be only a firm ligamentous union. When it is necessary to know whether the ankylosis is true or false and the surgeon is in doubt, he should administer an anesthetic and try to move the joint. As a rule, when the ankylosis is false motion can be detected, although it may be very slight. Occasionally, after an examination of this kind when no motion has been detected, there will be soreness in the joint, which is an indication that motion does exist, although it has been too slight for detection.

Prognosis.—The prospect of lessening a deformity in an extremity is almost always good, but the chances of restoring motion to a stiffened joint are not nearly so good. The prognosis depends largely upon the cause of the ankylosis and its character. An ankylosis due to a peri-arthritis from any cause can usually be cured; even when it is due to intra-articular adhesions motion may be restored, providing the adhesions are not too extensive. When they are very extensive motion can rarely be restored, no matter what the cause. The chances of restoring motion in a joint stiffened by tuberculosis are so slight that it is unwise to make the attempt, because there is great danger of causing a relapse of the disease.

After true bony ankylosis has taken place it is impossible to restore motion to the joint, but in some (the elbow- and shoulder-joints, for example) a false joint may be formed by excision which is greatly superior to ankylosis. Generally speaking, however, it is unwise to disturb a firmly ankylosed joint when it is ankylosed in the best possible position.

Treatment.—The aim of treatment in ankylosis is to overcome deformity, and, if possible, restore motion.

A very important part of the treatment of disease and injuries of the extremities is the prevention of ankylosis. A great change has taken place in the views of the profession upon this point within the recollection of the writer. Formerly the belief was that ankylosis resulted from preventing motion in the joint too long, and passive motion was considered the proper remedy in all cases. We have learned that inflammation is the one great cause of ankylosis, and that passive motion increases the inflammation and, therefore, is contra-indicated until the inflammation has subsided. We have learned that rest is the very best treatment for inflammation, and that it is, therefore, the best preventive of ankylosis. Even prolonged rest of a healthy joint will not cause ankylosis. With our present knowledge of the cause of ankylosis we understand that the measures best calculated to prevent it are those that will reduce the amount of inflammation to the minimum.

In acute or traumatic cases, antiseptic measures, with rest, followed, *as soon as the inflammation has disappeared*, by judicious passive motion and massage, will yield the best possible results. When it was believed that rest caused ankylosis, much harm was done by overzealous passive motion ; for example, in fractures about the elbow ankylosis was doubtless often due to the adhesive inflammation set up by injudicious passive motion.

In tubercular inflammation ankylosis is least likely to follow when the disease has been properly treated by rest and protection, because this treatment will reduce the inflammation to the minimum and, in the majority of cases, will prevent abscess. When suppuration occurs, there is almost certain to be some permanent loss of motion.

While passive motion is an excellent thing in its place, the writer's experience teaches him that it occupies a very small place in the treatment of tubercular joints. He has found that, aside from keeping the joint in the best possible position during treatment, the question of ankylosis need be given very little consideration.

About six months after all pain and spasm have disappeared from a tubercular joint, the apparatus should be removed, the amount of motion noted, and the patient advised to begin using the joint very moderately. If, after a couple of weeks, there is no return of the characteristic pain and spasm, and the amount of motion has increased, the joint may be considered healthy, and the patient can be advised to use it more freely.

Joints that have not been used for months or years cannot be expected to perform their functions at once or without some discomfort.

In superficial joints, like the knee, some swelling and tenderness will usually appear when they are first used, but these symptoms are of the character of a mild, simple synovitis, and will soon disappear. Massage is a very valuable aid in restoring these crippled joints to usefulness, but the physiologic use of the joint is the very best means through which to bring about the desired end. With judicious use the amount of motion will always increase in these cases.

In false ankylosis due to other causes, we should not be content with the amount of motion restored by use, but should resort to other methods. The amount of good that can be accomplished depends upon the cause and location of the ankylosis and upon the extent of the adhesions; but some good can be accomplished in almost every case, and sometimes joints that were seemingly hopelessly stiffened can be restored to usefulness.

The older method of treating these cases was by long-continued leverage by means of apparatus, but this method is not to be recommended, because it causes more pain, requires longer time, and does not yield as good results as the modern treatment by forcible breaking up of the adhesions. The surgeon's hands are the very best instruments for applying the desired force, because they are strong enough and will do no harm. The amount of force required to break up an ankylosed joint is often surprisingly small. The patient should be completely relaxed by an anesthetic and the joint alternately flexed and extended until the motions are free and easy. When the resistance is marked, it is better overcome by short, quick jerks than by steady pressure. The adhesions can be felt to yield, and, as they give way, either a short snapping or a tearing sound can be heard, which is rather alarming to the friends and inexperienced operator, but the danger of doing harm in this way is very remote. When the sound is short and snapping the prognosis is good, but when it is of the slow, tearing character the prognosis is not so good, for it will only be possible to secure a good result after long and painful treatment that will be abandoned by most patients. The snapping sound indicates that the ankylosis is due to short fibrous bands, while the tearing sound indicates adhesions over a broad surface.

The joint should be repeatedly flexed and extended to the extreme limit, and the limb put up in the proper position—that is, flexed in the elbow and ankle and straight in other joints—and kept quiet for three or four days by means of a splint. There will always be some swelling and pain following this operation, and there may be a slight rise of temperature. These symptoms are best controlled by rest and the local application of ice.

After three or four days, or as soon as the reaction has disappeared, passive motion should be begun. If there is so much pain and tenderness that the joint cannot be moved freely, an anesthetic should be given, repeatedly if necessary. It is rarely, however, that an anesthetic will be required more than two or three times, for where the adhesions are so extensive as to require this there is little prospect of securing a satisfactory result.

The ankylosis following a fracture is usually of the false variety, and is caused by the adhesions resulting from the adhesive inflammation and effusion following the accident. Passive motion applied before the bones have united and the effusion absorbed is more likely to cause than to prevent ankylosis, by increasing the inflammation and effusion. As soon as a fracture at or near a joint has united, passive motion should be tried, and if movements are quite free the physiologic use of the joint is the best treatment.

Cases of this kind coming under the surgeon's care at a later date should be treated by forcible flexion and extension under anesthesia, as previously described. The vast majority of these cases are at the elbow, which is not only a very frequent seat of fracture, but, owing to its uneven joint surfaces, is much more likely to become ankylosed than other joints. In breaking up this joint, special care should be exercised to prevent a fracture of the olecranon process and an injury to the ulnar nerve. Occasionally it will be found that the ankylosis in an elbow is due to a mechanical obstruction caused by a faulty union of the fragments ; in this event, it is proper, in young subjects, to open the joint under proper aseptic precautions and readjust the fragments, or trim them off in such a manner as to permit free motion. This is a legitimate field for good surgery, because improvement can always be expected, and frequently an almost perfect joint can be obtained with hardly any risk. It is needless to say that this is an operation that should only be undertaken by experienced operators.

In false ankylosis following suppurative synovitis the prospect of securing a freely movable joint is not very hopeful, because in these cases the adhesions are intra-articular and are apt to be extensive. This is frequently met with in the knee, and an effort should be made to improve the joint. When the patient is plucky and the surgeon persevering, much improvement can often be obtained by repeatedly breaking up the adhesions under anesthesia. In the knee, the patella should always be loosened before forcible flexion is undertaken or the bone may be broken. As a rule, it can be moved by pressure with the thumbs, but when this cannot be done, a tenotome should be introduced on either side of the bone and the adhesions separated. It may be necessary, in an old ankylosis at the knee, to tenotomize the hamstring muscles. When this is done, the proximity of the nerve to the outer tendon should be remembered.

False ankylosis following rheumatism can sometimes be very satisfactorily treated by *brisement forcé*, but the prognosis in these cases is not so good as some writers would have us believe. When the ankylosis is due to peri-arthritis or to a few intra-articular adhesions, this treatment will yield brilliant results; but when the intra-articular adhesions are very extensive, all treatment is liable to fail. Passive motion should always be tried in these cases, for it is impossible to tell until the effort is made how extensive the adhesions are.

False ankylosis at the hip-joint is not common from any cause except tubercular inflammation, when forcible correction is contra-indicated. It does, however, occasionally occur from other inflammations, and is then subject to the general rules of treatment already laid down in this chapter. Long-standing contraction of the psoas tendon cannot be overcome by extension. It is too deep to reach safely with a tenotome, but could, if necessary, be reached through an open wound.

The easier way to overcome the deformity in this case is by a subtrochanteric osteotomy, but this treatment is not nearly so satisfactory in false ankylosis as it is in true bony ankylosis.

The orthopedist frequently has cases of ankylosis referred to him which are either of the firm bony variety, or false ankylosis of such long standing that all hope of restoring the joint is gone. In these cases, when the limb is in the most useful position, it is very unwise to interfere with it. When, however, there is marked deformity, or the limb is in such a position that it cannot be used to the best advantage, operative procedures, with a view of putting the limb in the best possible position, are indicated.

At the shoulder-joint ankylosis is so well compensated for by the free movements of the scapula that it will rarely be advisable to interfere, although by an excision a movable joint may be secured.

When the elbow is firmly ankylosed in a flexed position it should not be interfered with, because what would be gained in motion by an excision would be lost in strength; but when the joint is ankylosed in a straight position an excision should be performed and an effort made to secure a movable joint.

The most common of these old deformities is at the hip-joint, and it is usually the result of a tubercular inflammation. The deformity almost invariably consists of flexion and adduction (Fig. 170). When it is so pronounced as to be quite noticeable and to interfere with locomotion, an operation should be performed to overcome it. Even when some motion is present, following a tubercular inflammation, correction by force is contra-indicated.

In 1826 Rhea Barton sawed through the neck and trochanter for the relief of deformity. In 1862 Lewis A. Sayre removed a roof-shaped piece from the femur with the hope of securing a movable joint. In 1869 Adams sawed through the neck of the femur (see Fig. 169, A), and in

1872 Gant performed a linear osteotomy below the lesser trochanter. The latter operation is the one now universally performed, and is one of the most satisfactory operations in surgery. The older operators hoped to secure a useful false joint, but experience taught them that that was not practical.

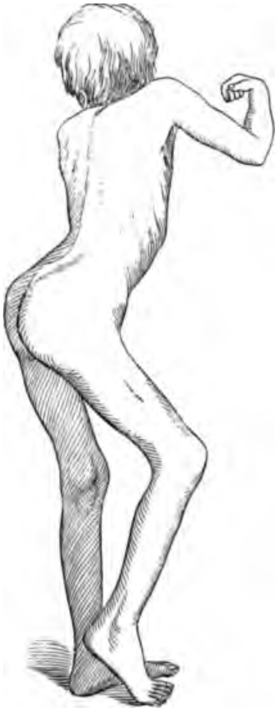

Fig. 167.—True ankylosis of the hip-joint from tuberculosis, and false ankylosis at knee from muscular contraction.

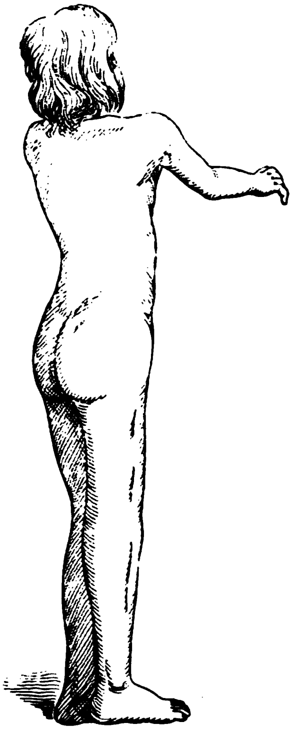

Fig. 168.—Same as figure 167, after osteotomy below trochanters and forcible straightening of knee. Good motion in knee.

Gant's operation (Fig. 169, B) is performed in the following manner: Strict asepsis must be observed, for with this precaution this operation is almost free from danger, and without it it may be very dangerous. An incision about an inch long is made on the outer side of the thigh, just below the trochanters, extending down to the bone and parallel with its shaft. Before removing the knife, an osteotome is passed down to the bone, alongside of the knife. The knife is then removed, and the osteotome turned with its cutting edge at a right angle to the bone. With a heavy wooden mallet the osteotome is driven into the shaft of the femur. The instrument should be moved from side to side after each stroke to keep it from becoming wedged in. The operator will know when it enters the medullary cavity, by the diminished resistance, and should then enter the bone again, either a little farther forward or backward, in order to cut the whole bone transversely. When there is slight motion in the joint the bone should be cut through, because an effort to complete the fracture by force might light up the old disease in the joint. When the ankylosis is bony, the femur need be cut only two-thirds of the way through, when it can be easily broken. A piece of gauze should be fastened over the wound by adhesive plaster, the thigh brought down parallel with the other one, and a plaster cast applied from the foot well up on the ribs. Special care must be exercised to overcome the adduction. Some operators advise Buck's extension and a long side splint, but the writer has always used plaster-of-Paris and with perfect satisfaction. It will often be found necessary to separate the adductors from their attachment to the pelvis by means of a tenotome before the adduction can be overcome. This operation is followed by very little pain or discomfort, and will run the usual course of a simple fracture of the femur. It causes no real shortening, and

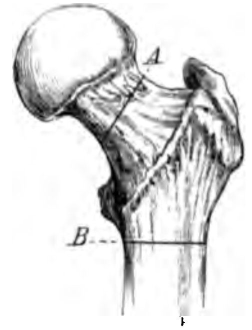

Fig. 169.—Osteotomy for ankylosis of hip. *A*, intracapsular (Adams' operation); *B*, extracapsular (Gant's operation).

adds considerably to the practical length of the limb. After six weeks the patient can begin to go about on crutches. In children the time will be at least two weeks shorter.

No effort should be made to secure a movable joint, because efforts in this direction will surely fail, and a movable point below the trochanters is undesirable.

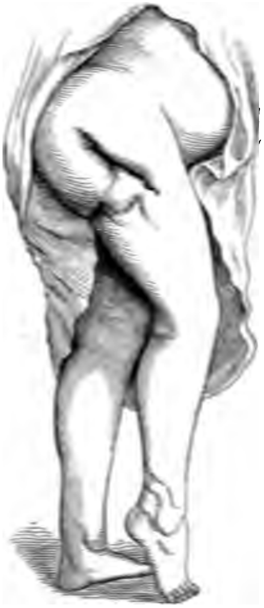

Fig. 170.—Extreme flexion, adduction, practical shortening, and lordosis, from severe hip-joint disease. Deformity so great that patient could not marry until after operation.

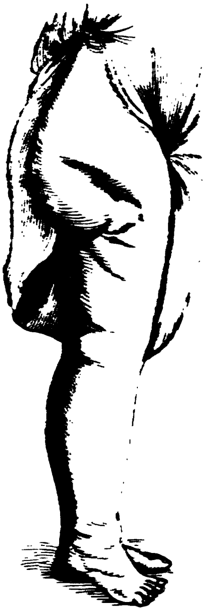

Fig. 171.—Same as figure 170, after subtrochanteric osteotomy, showing practical lengthening of limb and straightening of back.

The writer cannot recommend this operation too highly, because, when properly performed, it is safe, it relieves the patient of his deformity, helps him to walk with greater comfort, and reflects credit upon the operator (Figs. 170 and 171).

Firm ankylosis of the knee is quite common as a result of suppurative or tubercular inflammation, and when the limb is straight, or nearly so, it should not be disturbed. When the flexion is so marked as to be unsightly or to practically shorten the limb, an operation should be performed (see Fig. 167).

In 1835 Barton removed a wedge-shaped piece of bone from the femur just above the condyles for the relief of deformity, and in 1844 Gordon Buck excised the knee for the same purpose. In 1875 Barwell and Macewen performed a linear osteotomy above the condyles for the relief of deformity (Fig. 172).

This last operation, known as Macewen's operation, or its modification, MacCormac's, are the ones universally employed now. In extreme deformity it may be necessary to operate on the tibia, just below the joint, at the same time. The operation is performed in the same manner as previously described for the hip, the outer side of the thigh (MacCormac's operation) being the point of election for the incision. The section should be made as close to the condyles as practical, because when made too far away it makes the knee project too far forward. Care must be exercised not to allow the fragments to press upon the popliteal artery. Tenotomy of the hamstring muscles may be necessary. The limb should be put in a plaster-of-Paris dressing for from four to six weeks, according to the age of the patient. The results of this operation are very satisfactory.

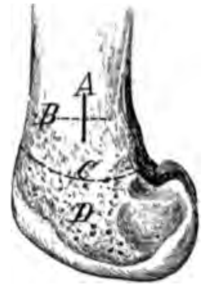

Fig. 172.—Macewen's operation: *A*, skin incision; *B*, osteotome incision; *D*, inner condyle.

When there is slight motion at the knee-joint, with flexion and subluxation of the tibia, an excision is indicated. Figure 173 A shows a case in which the writer exhausted every means known to him to restore the joint to usefulness because the tuberculosis was cured and there was some motion in the joint; but it was impossible to overcome the subluxation or to prevent its increase, so an excision was resorted to, with the result shown in figure 173 B.

Recently the writer has secured some very good results in these cases of subluxation and flexion by the use of Dr. Goldthwait's genuclast (Fig. 174). In careless or incompetent hands this would be a very dangerous instrument, for it exercises great power and might do irreparable injury

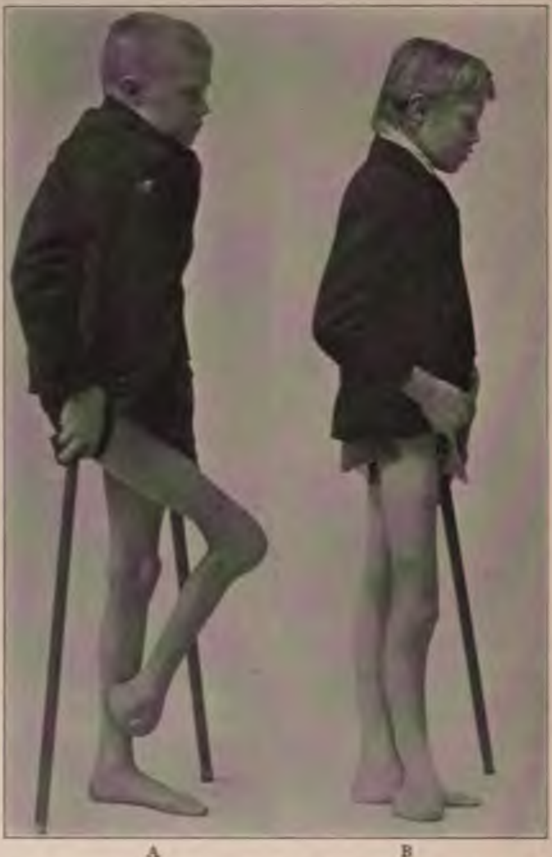

Fig. 173.—A, extreme flexion and subluxation of tibia following tuberculosis of knee; B, after incision of the knee.

by tearing the popliteal nerves or blood-vessels. In careful hands, however, it can be safely used and a subluxated tibia brought forward in cases that have resisted every other means known to the writer short of an excision.

Figure 175 A shows a case where a tuberculosis of the knee had recovered with limited motion, decided flexion, and genu valgum. The case had evidently been a mild one, without suppuration, and the deformity resulted because the child had had no treatment whatever. At one sitting the writer overcame the flexion and subluxation with the genuclast, and the genu valgum with the osteoclast. The knee was put up in a plaster cast and kept at rest for a few weeks. The result was very satisfactory, as seen in

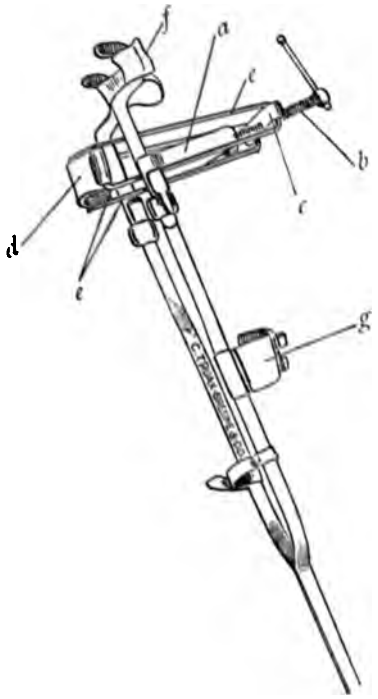

Fig. 174.—Goldthwait's genuclast.

figure 175 B. There was very little pain and no other unpleasant aftereffect.

The genuclast (Fig. 174) "has the advantage of an adjustable plate, so that by moving the arch (*a*) upon which the power is applied nearer to or farther away from the knee, it can be used upon a child or an adult. The application of the power in front, instead of behind, is more convenient and more easily managed. The screw (*b*) working in the arch (*a*) raises the cross-bar (*c*), to which the posterior band (*d*) is attached by means of the steel loops (*e*). The counterpressure comes upon the end of the femur by means of the leather pad (*f*), and, to a less extent, upon the strap (*g*). In using the instrument the plate (*c*) is forced forward, carrying the head of the tibia with it, and the counterpressure coming on the end of the femur by the

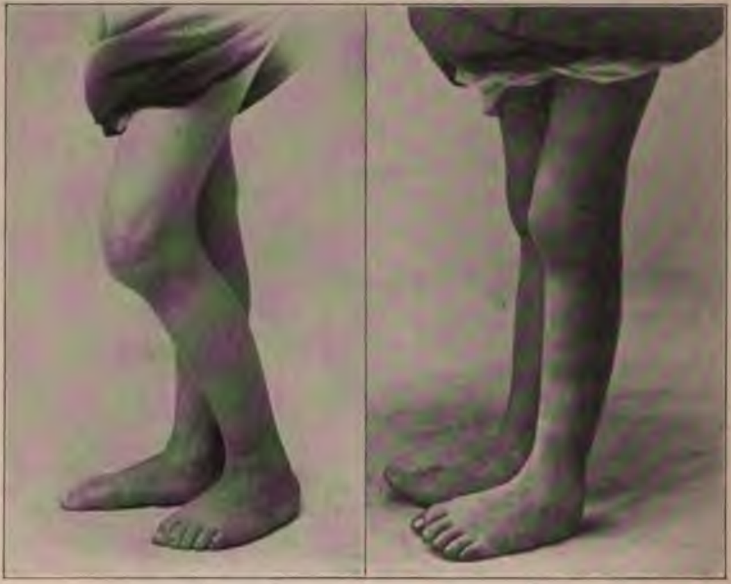
A B

Fig. 175.—A, flexion and genu valgum from mild tuberculosis; B, after correcting the flexion with genuclast and the valgum with osteoclast.

straps. After as much as possible has been gained in this way the leg is straightened, the strap (*d*) still being the fulcrum, the head of the tibia is drawn forward into its normal position."

At the ankle-joint the most frequent old deformity is that due to a Pott's fracture. The proper treatment for this deformity is a linear osteotomy of the tibia and fibula just above the ankle. After the bones have been broken, the deformity should be slightly overcorrected and held for a month or six weeks by means of a plaster bandage. The results after this operation are very satisfactory. Figure 176 illustrates a case operated upon by the writer with a very satisfactory result, the patient being able to work as a plumber with comfort.

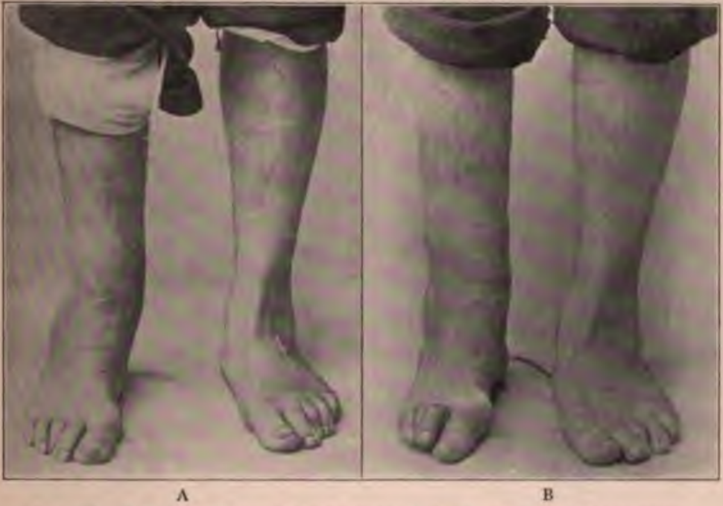

Fig. 176.—A, deformity from Pott's fracture; B, after supramalleolar osteotomy.

CHAPTER XXIV.

CONGENITAL DISLOCATION OF THE HIP.

CONGENITAL dislocation of the hip is usually a dislocation upon the dorsum of the ilium, although Ridlon, Phelps, Bradford, and Willard have reported cases in which the displacement was upward and forward. It occurs most frequently in girls, and in the majority of cases only one side is affected, although the double variety is not uncommon. It is a rare deformity, but not nearly so rare as is generally believed, because it is so often called by some other name. In a number of instances cases have come under the writer's observation that had been diagnosticated and treated as hip-joint disease.

Causes.—A number of theories have been advanced concerning the causes of this deformity, most of which are of no value from a practical standpoint ; but orthopedists quite generally agree that there are at least two different classes—viz., those resulting from a traumatism during or previous to labor, and those due to a lack of development of the acetabulum. It is easy to understand how a dislocation may occur during labor. Phelps * mentions a case in which he reduced a dislocated hip in a babe one hour old. That not all are due to traumatism is clearly proven by the fact that heredity has a decided bearing. Numerous instances have been reported in which mother and child both suffered from this deformity. In cases operated upon, it has been found that the acetabulum was only partially developed, while every other part was practically normal, so that it is natural to conclude that this lack of development was the cause of the deformity.

Symptoms.—The deformity is very liable to be overlooked until the child is old enough to begin to walk. He will usually begin late, and will walk in a peculiar, wabbling manner. When only one joint is involved there is shortening, flexion, and adduction, just as in a dorsal dislocation occurring at any age. When the deformity is bilateral there is marked lordosis (Fig. 177). Upon measurement, the trochanter will be found above Nélaton's line. There is

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* "Trans. American Orthopedic Association," vol. iv.

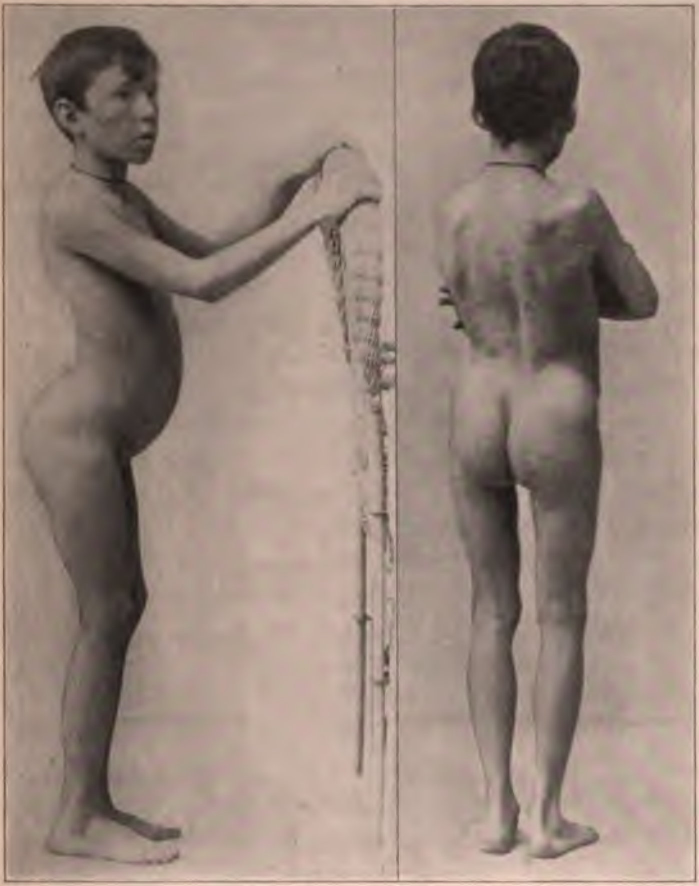

Fig. 177.—Double congenital dislocation of the hip, showing extreme lordosis.

usually quite free movement in every direction, except in abduction. The child tires easily, and cannot run so fast or play so long as other children. The symptoms of inflammation are absent, but in some cases pain is complained of after exertion. In the cases coming under the writer's observation pain was not a symptom, except in one instance in which a tubercular inflammation existed in the false joint.

Diagnosis.—The diagnosis is not difficult, and is based upon the symptoms above mentioned. It is most frequently mistaken for hip-joint disease, and is to be differentiated from it by the absence of atrophy, spasm, and fixation. This deformity will admit of some motion—usually quite free—in every direction, while in hip-joint disease there will be limitation of motion and the joint will usually be sensitive.

The crucial test, however, is the relation of the trochanter to Nélaton's line. Lay the child upon the well side, and draw a line on the afflicted side from the tuberosity of the ischium to the anterior superior spine of the ilium, and in dislocation the trochanter will be found above this line. This does not occur in hip-joint disease, and in the normal condition the tip of the trochanter is close beneath this line.

Prognosis.—The deformity does not improve, and in some cases it grows progressively worse as the patient grows older. A goodly number, however, go through life quite comfortably without any perceptible increase of the deformity. The writer has met with this deformity in adults who had grown up without having had a proper diagnosis made. Great benefit can be derived from either replacement after the Lorenze method or by the cutting operation.

Pathologic Anatomy.—There is always a trace of the acetabulum in children, but it is small and triangular. It is usually filled with fat. The head of the femur is flattened from side to side, and the neck is shortened and depressed. The capsular ligament is thickened and hugs the head and neck closely. It is drawn tightly over the anterior acetabular wall and is somewhat adherent to it. The ligamentum teres is rudimentary, and usually disappears after the fifth year.

Treatment.—A number of different methods of treatment have been recommended, but none of them have been entirely satisfactory. Mechanical treatment has been given a faithful trial, and is disappointing ; much time is required, and good results are not obtained. Buckminster Brown reported one case, in 1888, in which the results seemed to have been perfect, but a later report says that it has relapsed. Bradford * reports a case in which the result was satisfactory. The patient was kept in bed one year, and wore apparatus two years afterward. Most orthopedists using mechanical means advise rest in bed for a time, with extension by weight and pulley. Later some form of extension apparatus—usually a long hip-splint—is applied.

Paci recommends reduction by forcible manipulation under anesthesia, and reports 15 cases in which he obtained almost perfect results. Others, however, have not secured good results by this means, and it does not seem reasonable that they should, because, according to the author's own statement, the head of the bone is not replaced in the socket, but is brought near it, where it is not likely to remain, so that the child has been subjected to operative procedures, pain, etc., without receiving corresponding benefit.

Kirmisson recommended subtrochanteric osteotomy, and in certain cases in which the joint is quite firm and the deformity marked it would certainly be rational treatment. Excision of the head of the femur has been performed but does not improve the deformity much.

Within the past few years operative treatment, with a view of replacing the head of the femur in the acetabulum, has excited much attention. Hoffa, of Werzburg, first suggested the operation, which is performed as follows: An incision is made over the head of the bone somewhat after the manner of Langenbeck's incision for excision. The head of the bone is separated from the pelvis, and the muscles connecting the upper end of the femur with the pelvis are cut. The acetabulum is then scooped out. The bone is thick enough to admit of a free scooping out. The thigh and the knee are then flexed and the dislocation reduced. The head is then held in place while the thigh is gradually extended, stretching the muscles running parallel with the femur. Hoffa cuts all the short muscles connecting the upper end of the femur with the pelvis, claiming that they are the chief obstacle to reduction. Lorenze claims that these short muscles, instead of being shortened in dislocation, are really stretched, and that the resistance to reduction is from the long muscles. He advises that the short muscles be preserved and the long ones be tenotomized. Lorenze's operation is performed in the following manner: An incision is made from the anterior superior spinous process down between the tensor vaginæ femoris and the sartorius, exposing the joint. The acetabulum is scooped out, and, when necessary, the head of the femur is trimmed to fit. By powerful traction, by mechanical means if necessary, the head is brought into the acetabulum and dressings applied with the thigh slightly abducted. In bad cases it will be necessary to tenotomize the hamstring tendons.

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* See "Trans. American Orthopedic Association," vol. iv.

The after-treatment is the same for either operation, consisting of surgical dressings and a plaster cast until about the fourth week, when passive motion should be commenced, being careful not to overdo the matter.

After careful dissection, Bradford recommended and practised an incision along the trochanter in front of the line of Langenbeck's incision, and a secondary deep cross incision on the anterior surface of the capsule near the intertrochanteric line, through which the Y ligament is cut and the head of the bone freed from its attachments.*

The remote dangers following this operation are relapse, limitation of motion, adduction, and flexion. Relapse and deformity are best avoided by protecting the joint for some months after the operation, by mechanical means, preferably by a long hip-splint. Mobility is to be increased by judicious passive motion and massage, beginning about the end of the fourth week after operation. This is a notable instance in which the best results are to be obtained by the combination of operative and mechanical treatment. The neglect of proper and painstaking mechanical treatment following this operation will surely lead to disappointment.

Hoffa does not claim perfect results, but his success, barring the slight mortality-rate, is certainly a great improvement over older methods. Lorenze reports 230 cases operated upon by his method up to September 25, 1896. His first 90 cases reported up to August, 1894, were said to be without a single failure, which is almost too good to believe. This statement, however, must apply to the immediate success of the operation, since it was published in the "Transactions of the American Orthopedic Association for 1894." Hoffa has a specimen obtained from a child who died of diphtheria after complete recovery from his operation. A good joint was formed, and the acetabulum, which was formed in soft, spongy bone, was covered with a layer of hyaline cartilage.

Myers has collected 177 cases of Hoffa's operation from various sources, and the mortality was 3.3 per cent., mostly from shock and hemorrhage.† Operation is not advised by Hoffa in patients over ten years old.

The majority of persons suffering from this deformity go untreated and are just about as well off as those who have been treated mechanically, so that the question is, practically, Shall we operate upon these cases or allow them to go untreated? The writer has not, up to a comparatively recent date, felt justified in operating, because of the mortality connected with it, and because he still had hopes of accomplishing something by mechanical means which is without a mortality-rate. At the present time, however, he is satisfied that mechanical treatment does not result in enough improvement to justify the annoyance and expense connected with it, and he is also satisfied that the only hope of cure lies either in this operation or in the bloodless reduction of Lorenze presently to be described. The deformity is always unsightly and usually disabling, and an operation is certainly justifiable. No one should undertake to perform the cutting operation who is not an experienced operator and sure of his technic. There will always be a small mortality-rate, because with perfect technic the shock remains; but even this will be reduced as operators gain in speed through experience.

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* See "Trans. American Orthopedic Association," vol. vii.

† *Ibid.*

The most recent advance in the treatment of congenital dislocation of the hip is the bloodless reduction of Lorenze, which is the outgrowth of his large experience in the cutting operation. Making due allowance for the enthusiasm of its advocates, reported results surely indicate that through this operation we are destined in future to secure our best results. It is only applicable to cases under seven years, and is best adapted to those under four years.

The following description of the operation is a condensation of Lorenze's own description, as given in the "Transactions of the American Orthopedic Association," vol. ix, p. 254:

The first step is to bring the head of the femur down to a level with the acetabulum, by means of extension with the hands, or, if necessary, by mechanical means. This can usually be accomplished in a few minutes when the patient is profoundly anesthetized. The tip of the trochanter must be brought down to or a little below Nélaton's line. The head should be felt below and well to the inner side of the anterior superior spine of the ilium. The traction should be even and steady, to avoid fracture.

The second step, designated by the author "reposition," is the most difficult part of the proceeding. The thigh is flexed so as to bring the head of the femur back of the acetabulum. It is then slightly rotated inward and gradually abducted, until the head slips over the rim of the acetabulum with an audible sound. This does not occur until the abduction has reached about 90 degrees. While the operator is abducting and rotating the limb with one hand, he should manipulate the head of the bone with the other hand, so as to guide it into the acetabulum. After reduction it is found that, as the limb is adducted, the head of the bone slips out of the acetabulum. It is necessary, therefore, to fix the limb in extreme abduction, which constitutes the *third* step in the operation. The thigh is abducted to the limit, slightly rotated outward, and hyperextended, in which position it is held by a plaster cast extending down to, but not below, the knee. This first bandage is left on for three months. As early as possible the child is induced to walk, the extreme abduction of the afflicted limb being compensated for by elevating the shoe on the well side from two to four inches. This throwing of the weight upon the recently replaced femur causes a rapid development of the acetabulum, and is a distinctive feature of the Lorenze operation.

After three months the bandage is removed and the stability of the joint tested. A second cast is applied, possibly with the degree of abduction somewhat reduced, and is left for three months. After this it is usually possible to retain the abduction sufficiently by the elevation of the shoe on the well side. This elevation should be gradually reduced until the tendency to relapse has disappeared. In all manipulations the abduction must be carefully maintained. The contraction of the stretched muscles plays an important part in the acetabulum-forming process. It is claimed that the aftertreatment is shorter after the bloodless operation than after the cutting operation. One point in favor of this operation is that, should one fail, after judicious effort, to reduce the luxation, he has done the patient no harm. When the dislocation is double, only one side should be operated upon at one time.

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